THE
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WASTE LABOUR.

IT is impossible to withhold one's sympathy from the moving appeal set forth in our "Correspondence" columns by the Secretary of the B.E.A.M.A. to-day; the abuse to which he draws attention is as notorious as it is onerous. Not only in connection with drawings and prints is it experienced, but also in the more costly items of complete tenders for sections of the plant which is to be placed on order. As we have pointed out on previous occasions, it is not unusual for the maker of a dynamo to submit a number of alternative tenders incorporating the engines of different makers in his offer for the combined set, and sometimes the engine builders also tender separately, with various dynamos. The consequence is, of course, that innumerable drawings and specifications are required, the aggregate cost of which constitutes a very heavy burden upon an industry already sufficiently laden with costs and taxes and crushed by excessive competition. In the long run the purchaser has to pay the bill for the whole, and the consulting engineer is distracted by the multiplicity of tenders, differing but little in essentials, and therefore all the more difficult to appraise in order of merit.

Never was it more necessary to cut down unproductive expenses and to minimise the waste of labour than it has been during recent years; it is true that we are just now passing through a phase of exceptional prosperity, but that is no excuse for extravagance on the part of the industry, any more than it would be in the case of an individual. Now is the time when reasonable profits should be made to compensate for all those lean years that we have experienced, and that may possibly recur. The methods of shop management have undergone a revolution; the output of each workman can now be measured and checked to decimal fractions, and the utmost care is exercised in up-to-date workshops to abolish loss of time and waste of labour in every department; it is no less important that the demands of external sources shall be similarly scrutinised and whittled down to the lowest possible degree consistent with efficient salesmanship and satisfaction to the purchaser. The particular type of oppression cited by Mr. Dunlop affords a flagrant instance of thoughtlessness and futility. The practice may be due, as he says, to the bad habits contracted by engineers' assistants, to whom the asking for a superfluity of information comes easily, without regard to the cost of supplying it; but even if this be the case, the principals are wholly responsible for its continuance. There is no mystery or complexity about ordinary switchgear to justify the provision of detailed drawings in the preliminary stages; any competent junior draughtsman can prepare the designs, but that is no reason for setting an army of junior draughtsmen and photographers at work, all doing the same thing, and all but one of them doing it to no purpose. Such staff might be more profitably employed in preparing photographs and drawings of completed work for publication in the technical Press—a direction in which our firms are sadly wanting in enterprise in comparison with their Continental rivals.

Apart from the fact that the purchaser is the loser in the end, there is another consideration which cannot fail to appeal to every patriotic engineer—the welfare of the industry in which he is himself engaged—and we hope that the widespread attention that is now being given to the subject will induce him to take prompt action to put an end to the waste of other people's time and money. The Association has done well in taking this step, and we trust that it will be no less earnest in removing the many other obstacles with which the manufacturing engineer is confronted in this country.

The Manchester Street Lighting Reports.

So the cat is out of the bag; the great fiction which has resulted in Manchester being a city of outer darkness—a by-word in the matter of street lighting—is at last exposed. Even the Gas Committee, on which rests the responsibility for the gloomy Manchester that we all know, cannot very well cavil at a report which is jointly signed by a recognised enthusiast in the cause of street lighting by gas.

To be confronted with a discrediting report, which cannot but reflect on the part played for so many years by those responsible for inefficiently lighted streets, is bad enough, but to know that that report is subscribed to by a zealous admirer—even though with transparent unwillingness—is infinitely worse. Yet such is the plight of the Manchester Gas Committee, now happily superseded by, let us hope, an impartial Street Lighting Committee, so far as street illumination is concerned.

In the early summer the City Council, in order to decide what had become a burning question in more senses than one, arranged for a joint investigation, by Messrs. Haydn Harrison and Jacques Abady, of the rival systems of flame-arc lighting and high-pressure gas lighting, a typical installation of each kind having been arranged for the purpose in Portland and Princess Streets respectively. The joint and individual reports of these gentlemen are dealt with elsewhere in our pages, and it is sufficient here to say that both of them agree that the illumination in the two cases is approximately the same, but that the cost of the electric lighting is considerably less than that of the high-pressure gas lighting.

Mr. Harrison goes further in his separate report, stating "that had the gas lamps been working at double the efficiency, or the cost of electrical energy been double what it is, the electric arc lamps would still have proved to be the more economical for equal illumination."

But we can safely leave Mr. Harrison's own report to the judgment of our readers; it deals concisely with ascertained facts, and is unobscured by generalities.

Mr. Abady's separate report is much more extensive, and, indeed, he appears to have expanded the reference to cover matters far removed from the relative merits of the rival installations in Portland and Princess Streets, a proceeding which, we are compelled to assume, arises from the necessity for making the most of the very poor case for high-pressure gas lighting. Mr. Harrison accepts the figures of costs given by the Manchester electricity and gas departments, and draws a straightforward comparison between the two installations; not so, however, Mr. Abady, who interprets the reference to include an invitation to criticise not only the electricity and gas department's costs "if necessary," but also the respective installations.

The words "if necessary" are significant; never was it more necessary to juggle with obstinate facts and figures, to gloss over the fatal deficiencies of gas lighting, and to damn by the faintest of praise the excellences of its great rival electricity, and Mr. Abady's gas friends must needs admit that he has left no stone unturned in their cause.

The all-important fact remains, however, that he himself considers "that, based upon the figures of cost given by the electricity and gas departments . . . . the Manchester Corporation gas department cannot supply for public lighting purposes three-burner high-pressure lamps at as low a cost as can the electricity department supply for public lighting purposes 11-amp. flame arc lamps."

However, as the drowning man will clutch even at a straw, so Mr. Abady, with the gas instinct uppermost, grasps at anything which may keep his reputation as a gas enthusiast afloat. And the straws in this case are even more intangible than usual.

It is, however, needless to enter into the various excuses and specious arguments advanced by him in the cause of gas; even he must realise the utter hopelessness of a case which compels him to advance such a statement as the following:—"It is also a fact that light given by a . . . gas mantle contains a larger percentage of this useful light than does the light given by an arc lamp. That is one of the reasons why a street lighted by high-pressure gas lamps is so noticeably brilliant, a fact which, because it cannot be measured, cannot be expressed in £ s. d.," or to urge in its favour the preponderating subsidies of the gas department to the rates—subsidies which are due in part, at least, to that department having given such poor value for money in street illumination in the past.

Moreover, Mr. Abady goes out of his way to criticise matters of which he cannot expect to be regarded as a competent judge, *i.e.*, the fixed and running charges of the Manchester Electricity Supply. As these have been discussed from time to time, our readers will be aware that at Manchester the fixed charges for traction are based on plant which has been practically reserved for traction purposes, and are, therefore, somewhat higher than the fixed charges due to the large turbine plant installed solely to meet the rapidly developing power supply business.

The traction charges, however, benefit in the general reduction in running charges from year to year: this arrangement is probably as equitable as dividing up the whole of the capital expenditure *pro rata* to the maximum demands for power, lighting and traction, and basing the fixed charges thereon.

However, in such case a brief calculation will show Mr. Abady that even lower values are obtained, viz., £7·6 per KW. of M.D., plus ·223d. per unit running costs, as compared with the £7·5 per KW. and ·232d. per unit adopted by Mr. Abady in calculating the cost of electric lighting in the report.

The pill, despite Mr. Abady's attempted gilding, is the bitterest by far that our gas friends have had to swallow; pill?—we might almost say emetic.

Motor-Hiring at Leeds.

The controversy on municipal motor hiring, which appears to be claiming the close attention of a section of the industrial community of Leeds, revives once more one aspect of the old question of municipal *versus* private trading. In this case a proposal was brought forward by the Electricity Committee that the Corporation should borrow the sum of £10,000 with a view to financing and establishing a department for the hiring of electric motors—a method of development which has brought much grist to the mill in other towns similarly situated.

Officially the Leeds traders will, however, have none of this, and in view of the active opposition aroused, particularly on the part of the electrical fraternity in the city, the Council, after considerable discussion, referred the matter back for further consideration by the Committee, so that the issue is still undecided.

Quite apart from the Committee's proposal, and its real or imagined effect, it is worthy of examination whether the electrical trade opposition to this particular phase of development of a municipal department which is *un fait accompli*, is not short-sighted. Neither from a commercial nor a municipal point of view can it be contended that the Leeds electricity department has failed in its objects, but it is quite arguable that these objects would be more fully attained if prospective users of electric power were able to test the soundness of electric driving without, as they may think now, having a possibly useless motor left on their hands.

If in a city like Leeds electric driving is to be confined to the people who can afford to purchase their installations outright, it must be obvious that a large proportion of the small and, no doubt, some large power users—potential consumers who are hesitating on the score of first cost—will be indefinitely lost to the supply undertaking and to the local electrical firms as well, if they would only see it, for they forfeit the prospective wiring under the Electricity Committee's scheme, and, with one exception, are apparently unable or unwilling to offer any facilities for motor hiring comparable with those under the scheme.

As we understand the matter, electrical contractors, speaking generally, are quite willing to give in on this point of motor-hiring, which, obviously, would mean in most cases a larger lock-up of capital than they can stand, if electrical wiring and installation work be left to them. This being so, it is difficult to understand why Leeds firms are anxious

to hinder a policy which, we believe, would make for a better development of the city's own undertaking. We recognise the importance of the principle involved, but there are some things which a public authority is by nature better fitted to handle, and one of these, as it appears to us, is motor-hiring.

It is undeniable that a great field exists for the hire of motors and other apparatus by electricity supply undertakings, and one need only turn to the rival gas undertakings for proof of this. What proportion, for instance, of the 20,000 gas cookers, which the people of Norwich are credited with using, would have found users if some hiring scheme had not been in operation, and how could local firms have financed the huge business which has actually been built up?

Again, the neighbouring city of Bradford had 1,732 motors on its mains at June, 1911, and of these the larger proportion, viz., 919, were hired by their users, and, no doubt, maintained in efficient order by the Corporation, a factor of no small importance to the small power user.

The problem of the small power user who cannot afford to purchase apparatus outright, and of others who prefer for various reasons to hire rather than purchase, has to be faced in some way, and it is quite evident that co-operative, and not obstructive, tactics will lead to the most profitable all-round solution of the matter.

The Powers of Directors.

ANYONE who holds the position of director of a public company must sometimes wonder what is the extent of his powers. This is especially the case when he sees the affairs of the concern practically run by the managing director or the chairman, and he feels that he has little or no power. So far as the direction of policy is concerned, it may be a one-man company. A correspondence has recently appeared in the *Times* with reference to the powers of directors. It was initiated by a gentleman who wrote to complain of the present state of company law. It appears that he had obtained the opinion of an "eminent counsel" to the effect that a director has no right of access to the books of a company unless he is specially authorised in that behalf by a resolution of the board of directors. This opinion has evoked a storm of disapproval, and having regard to the authorities cited by those who disapprove, it may be regarded as erroneous. Although directors can, *primâ facie*, only act by resolution passed at a duly convened board meeting at which a quorum is present, and no director has individual powers unless delegated to him, yet the directors of a company are the managing partners of the concern, and as such are entitled to the same right of access to the books of the company as the members of an ordinary partnership. In Burn *v.* L. and S. Wales Coal Co. (W.N. 1890, 209) it was expressly held that a director has a right to inspect and take notes of all documents held for the company *virtute officii*. Lord Justice Buckley, in his work on companies, appears to hold the same view, when he says :—

> It is the duty of the directors (a duty which they have undertaken to perform in becoming directors) to be acquainted with the proceedings of the board of which they are members. A director cannot, therefore, semble, escape liability by professing ignorance of a state of affairs which he might have learned from the books of the company. But knowledge of all the entries in the books will not be imputed to him.

English law is sometimes vague and uncertain, and it must be admitted that in that lengthy Act which consolidated the law relating to public companies in 1906, there is no special provision dealing with the question in hand. It would, however, certainly be surprising if the position of director, which involves very great responsibility, did not carry with it the right to make the most minute inquiry into the affairs of a company.

The "Point Fives."

THE announcement which reached us last week that another borough electrical engineer—Mr. Allen, of Carlisle—had been elected to the select assembly known as the "point fives," reminds us that these—shall we say courageous?—gentlemen are now ten in number.

That they have been able conscientiously to adopt what are, by comparison, extremely advanced views in the matter of domestic electricity supply is all to their credit, and undoubtedly very gratifying and satisfactory to their consumers. It is no secret, however, that some engineers, men whom we and they respect for their sound views, look with some misgivings at the ½d. unit when it is unaccompanied by a fixed charge based on the connected load.

One cannot blame them for this. It is not so much a question of the normal consumer's peak load as of the abnormal consumer's possible peak load, assuming that such consumers take every possible advantage of the temptation which is purposely held out to them to adopt electric lighting, heating, cooking, &c., throughout. There is no doubt that consumers on a rateable value assessment tariff will, if they fulfil expectations, tend as a whole to become abnormal consumers in the matter of lighting and heating, whatever they may be as regards cooking, and, so far, nothing definite appears to be known as to the net effect of their increasing connections on the peak load.

Our remarks do not refer particularly to cooking loads, which, one might judge, from statements made at the Harrogate Convention in June last, are as likely as not to be "off-peak" loads—at any rate, this is the experience of such divergent localities as Marylebone and Luton. The whole question is admittedly an involved one, but probably the engineer who adopts the ½d. rate risks far less than other people suppose, and plays for far higher stakes than he is himself aware of. The engineer has a great ally in the steadily falling fixed charge, and an even greater in the mysterious diversity of habit of his consumers.

In conclusion, one might suggest that there is still scope for the "point five," who feels inclined to become fractionally smaller still, to consider some scheme of heating at "so much per room" during the winter months. Small heaters suitably placed and automatically controlled by a thermostat placed, say, on the ceiling, and adjusted so as to maintain a temperature of about 60° F., might meet the case; but, of course, it needs a really simple and reliable method of temperature control and a relatively low charge per unit, neither of which may materialise just yet.

Country House Installations.

THE article printed elsewhere in this issue, describing the electrical installation at Stoneleigh Abbey, may be regarded as illustrating the best modern practice in country-house equipment. It is not often, perhaps, that the engineer has so free a hand to carry out an installation as he considers it ought to be carried out. Usually, he is more or less bound by competition to effect a compromise between what is best and what is expedient, frequently with a considerable bias towards the latter, but in this case, we believe, the best has been demanded and supplied.

The fire-fighting installation is particularly interesting, being designed on novel lines, and marking a great advance even upon the up-to-date system previously in use at the Abbey. Taken in conjunction with the article on private house water supply, recently published in our pages, which attracted much attention, it indicates a useful opening for electricity supply in country houses, and in other connections also.

Electric cooking is another direction in which country houses offer a wide scope for development. Here it is free from all competition except that of the coal range, and, once tried, cannot fail to score a triumph.

It is regrettable that the uses of electricity in agriculture are still but little appreciated in this country; we have endeavoured to bring them home to our readers by inserting descriptive accounts of work that has been accomplished abroad, and we fully believe that eventually, when the British agriculturist realises the extreme convenience, economy and elasticity of electric power, he will be glad to avail himself of its advantages.

AUTOMATIC CURRENT REGULATION DURING EXHAUSTION OF INCANDESCENT LAMPS.

[COMMUNICATED.]

In any process, such as the manufacture of incandescent electric lamps, which involves passing work through a number of departments, it is often difficult to trace defects in the final product to the department primarily responsible. A certain percentage of incandescent lamps have to be rejected as "outfalls" when tested on the photometer, owing to incorrect treatment either in the filament mounting or globe exhausting stage of manufacture. This leads to special annoyance and loss when fulfilling urgent orders. Not only may delivery be delayed beyond the promised date, but also, especially if the order is for lamps of unusual candle-power or voltage, the maker gradually accumulates a stock of "outfalls" for which there is very little demand.

The two most delicate operations in the construction of an incandescent lamp are the mounting of the filament, and the exhaustion of the bulb. Up to the present a very considerable number of lamps have been seriously injured by the incandescing of the filaments at too early a stage in the exhaustion of the bulbs, and by delay in opening the supply circuit in case of failure of the vacuum.

The apparatus described and illustrated in the following paragraphs is due to A. Stifter, and provides for the automatic switching-in of lamps when such a vacuum has been attained that the filament may be safely incandesced, and also for automatic opening of the supply circuit in the event of the explosion of a bulb or serious deterioration of vacuum by leakage in a bulb or its connections. The attendant's duty is limited to mounting and sealing-off lamps; hence, a reduced staff can deal with an increased output, while, by the action of the automatic circuit breaker, the number of the spoiled and "outfall" lamps is greatly reduced.

Referring to fig. 1, the mercury vacuum meter a controls a local circuit containing the switch solenoid d; the resistances b_1—b_7 are of any convenient resistance material, and are provided with intermediate platinum contacts fused

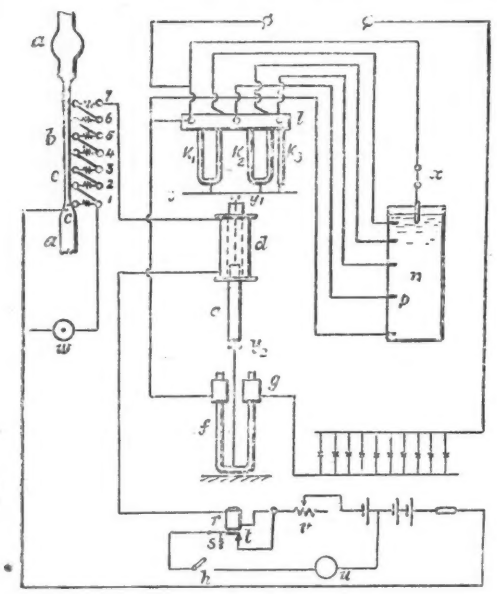


Fig. 1.

through the wall of the vacuum gauge. When the mercury has risen to a height corresponding to that vacuum at which the lamp can safely be incandesced, the contact c is closed, and current flows from the local battery through the whole of b, and the coil d. The core e is then raised so far that the conducting part of the U-bar f (see also fig. 2), is drawn into the mercury cups g, thus closing the lamp circuit. If the filaments have been mounted properly, they now become duly incandescent, and the isolating switch h in the alarm bell circuit is closed.

Above the coil d is an insulating plate i carrying contact bars k_1, k_2, the construction of which is shown in fig. 3, which imagines the ring of bars developed into one plane. The actual arrangement is shown in plan in fig. 4. At the moment when f closes the lamp circuit, these contact bars make no connection between sections m_1, m_2, &c., of the ring l, hence, for the time being, the lamp current traverses the whole of the liquid resistance column n.

Meanwhile the lamp vacuum is increasing, and when the mercury level in the vacuum gauge reaches o, the section b_1 of b is short-circuited, and the current through d being thus increased, the core e is raised further and the conducting limbs of k make contact between m_1, m_2, thus short-circuiting part of the resistance n, with the result that the lamps

Fig. 2.

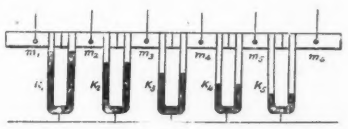


Fig. 3.

burn more brightly than before. The same cycle is repeated till, by the time the mercury in the vacuum gauge reaches b, the whole of n is short-circuited and the lamps are supplied at 10 per cent. over-voltage.

Suppose now that a lamp explodes, or a leakage occurs during the exhaustion, the mercury level in a at once sinks below c, the coil d is cut out of circuit and the lamp current is rapidly reduced, as k_1, k_2, &c., descend, and finally the switch f is opened. The core e descends under its own weight and that of the contact gear; no control spring is used. The opening of the control circuit permits the armature of r to fall, with the result that the alarm bell u at once commences to ring and attracts the notice of the attendant, who opens h, remedies the defective condition and recommences the exhaustion. At the most one lamp is lost. Should the switch h not be closed after the lamps have been switched in circuit, the automatic action of the main switchgear is unaffected, but the attendant may for some time fail to notice that the vacuum has been lost and the lamp circuit opened.

Should the vacuum fail temporarily after the switching-in of the lamps (owing to a sudden emission of occluded gases, or the drying-out of moist joints), the push w may be compressed, thus keeping the local control circuit closed

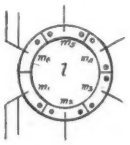


Fig. 4.

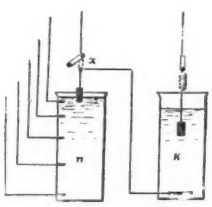


Fig. 5.

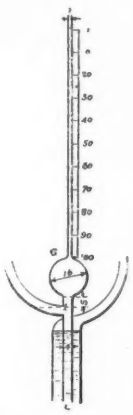


Fig. 6.

until the mercury level in the vacuum gauge again rises above c. Temporary loss of vacuum by the above causes is easily distinguished from the sudden large and permanent loss of vacuum due to in-leakage. To avoid oscillation of the core e occurring when temporary vacuum variations are set up during exhaustion (thus leading to a temporary uncovering of one or more contacts b), a cylindrical damping capsule is provided.

When dealing with lamps of abnormal voltage or candle-power, a second liquid resistance may be connected in series or parallel with n, as shown in fig. 5, after opening the isolating switch x. The effective value of the supplementary resistance may be varied by raising or lowering K, or varying the water level, or by the addition of a few drops of acid or alkali. Every type of lamp can thus be handled

simply and rapidly, and to avoid risk of injury, the whole apparatus is so enclosed that only the vacuum gauge is visible, and the switch h and push w are accessible to the workman.

In order to make the contact loops k as light as possible, the conducting length may be made up of aluminium 1—5, but it is then impossible to use mercury at m_1, m_2, &c., and some other means of effecting efficient contact must be employed. As compared with copper and the noble metals, aluminium has high conductivity, while possessing very low specific gravity.

If aluminium be used, the weight of each contact loop need not exceed 12 gm., and it is possible, by using glass (specific gravity, 2·65), or quartz (specific gravity, 2·5—2·8) for the upper insulating part of the U bars, to load the ring i very symmetrically, thus reducing the friction of the guide rollers y_1, y_2. Probably, however, the surface film of oxide forming on aluminium and the impossibility of using this metal in mercury cups would make it desirable to use some other, though heavier, metal. The contact length of the main switching piece f may be made of carbon (in order to reduce damage by sparking when opening the lamp circuit) and the upper part of quartz.

Residual Pressure at which Lamps may be Incandesced.—It is sometimes recommended that lamps should not be incandesced until the residual pressure of gases in the bulb has been reduced to 0·00013 atmosphere, but experience shows that no damage occurs if filaments are incandesced when the pressure reaches 0·00262 atmosphere; it must be remembered that a considerable part of the residue is by this time composed of inert gases from the filaments and joints, &c., which gases have no oxidising or other injurious effect on the incandescent filament. There is a distinct advantage in incandescing the filaments for as long a period as possible during evacuation, and this particularly applies to metallic-filament lamps, owing to the large number and surfaces of parts within the bulb, and (except in the latest types) large number of cemented joints.

It is especially important that the point (c) (fig. 1) be correctly chosen so that the lamps are switched in immediately, but not before, that vacuum is reached at which the filament can be incandesced without injury.

Fig. 6 represents part of a standard vacuum gauge. The right-hand tube is open to the atmosphere, the central stand-pipe is sealed at the top, and the left-hand tube is connected to the exhausting system. During the exhaustion of the lamps, mercury rises in the centre tube L, and when it reaches level 1, the stand-pipe G is isolated from the left-hand tube. As the mercury rises yet higher, the rarefied air in G is compressed, and by the time the mercury reaches, say, the 10 mark, on the scale, the vacuum in the lamp has reached such a value that the filaments can safely be incandesced. The corresponding mercury level in the vacuum gauge under calibration can now be marked, and thus the point c determined.

The dimensions shown in fig. 6 are in mm., and in the present case v = volume of stand-pipe above 1 = 2,286 mm.^{3}; v_2 = volume of stand-pipe above scale mark 10 = 7·85 mm.^{3}; p_1 = lamp vacuum corresponding to v_2, and requiring to be determined; p_2 = pressure of air in v_2. The pressure p_2 can never reach 1 atm., but its value at any moment can be calculated as follows:—

The diameter of L = 4 mm. and v_1 = 2,286 mm.^{3} corresponding to a column 182 mm. in height, and therefore a pressure of 0·238 atm., *i.e.*, p_2 = 0·762 atm. Then, from Boyle's Law—

$$p_1 \cdot v_1 = p_2 \cdot v_2,$$

whence, substituting the above values for v_1, v_2 and p_2,

$$v_1 = 0\ 00262 \text{ atm.}$$

Having once determined experimentally the critical residual pressure at which given filaments can safely be incandesced, the corresponding volume v_2, and hence the scale mark to which the mercury must rise in the stand-pipe of the vacuum gauge (fig. 6), can be calculated by the inverse of the above process.

An ultimate vacuum of about 0·002 mm. ($2{\cdot}62 \times 10^{-6}$) suffices, hence the difference between the vacuum at which the filament is first incandesced and the vacuum when exhaustion is considered complete, corresponds to about 2 mm. height in the vacuum gauge (fig. 1), and to increase this height sufficiently to enable the seven contact wires b, &c., to be fused through the glass, the diameter of the tube is locally constricted from 5 mm. to about 1·3 mm., thus providing a length of nearly 30 mm. for the control contacts.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Institution of Electrical Engineers.

I notice that the above Institution threatens to come off its pedestal and do something for its ordinary members.

We have lately had a good illustration of what the "strongest Trade Union in the world"—namely, the Medical Association—can do for the medical man. Imagine our Institution saving their fully-qualified members from the 17s. per week job, in charge of 40s. to 80s. per week workmen. The workman has his Union, the 17s. engineer only the Institution of Electrical Engineers.

The *Electrical Times* tells us that recruits to the Institution "will find that membership will be of increasing value to them in their careers." I wish the word increasing had been left out; then one could recruit with an easy conscience. "Professional status in the electrical world" is all very well in its way, but it does not help some of us to earn an unskilled labourer's pay.

The Medical Association takes very good care of the professional status of the doctors: but, what is more, it also helps them to live. Overcrowded as the medical profession is, one cannot employ a doctor for 17s. per week, neither is it possible for a chemist to pretend he is a qualified medical practitioner.

When will our Institution become less dignified and more useful to the majority of its members? I am sure none of us would mind paying double or even treble our present subscription if we could feel as the doctors must now feel in regard to their own glorious and dignified "Trade Union." If the above ever comes to pass, there will be no need for members to recruit as at present. The difficulty will be to keep unqualified men out of the Institution of Electrical Engineers.

When shall we see at the head of your advertisement column:—"Before applying for the post of electrical engineer under the ——— Corporation, intending applicants are requested to apply to the Institution of Electrical Engineers"?

A. J. Abraham,
Engineer and Manager.

Aberdare Electricity Works,
October 23rd, 1912.

Switchgear Drawing-Office Expenses.

I am directed by my Council to invite, through the medium of your valued paper, the attention of municipal and consulting engineers and other principals interested in the purchase of switchboards, switchgear and apparatus to the burden at present imposed upon manufacturers by demands for drawings, the cost of preparing which is, in many instances, largely disproportionate to the value of the orders for which they are prepared.

It appears to be customary—the custom originating, no doubt, in competition, and now sanctioned by use—in every instance at the *inquiry* stage of a switchgear order, for purchasers to ask each tenderer for special drawings, irrespective of the size or value of the apparatus inquired for; and it is, thus, not unusual for a maker, when acting as sub-contractor, to be requested by a dozen different firms to supply, for tendering purposes, of each section of the order, a dozen sets of drawings in duplicate, together with blue prints and diagrams of connections and dimensions, the order itself being of the value of, perhaps, not more than £10. In the case of intermediate sub-contractors making the

demand on behalf of some main contractor, the work is doubled, and may even be quadrupled.

It is submitted by members that, while in the case of large special switchboards, detailed lay-out drawings may reasonably be required, in the majority of cases an immense wastage of time and labour takes place in the manufacturers' drawing offices, most of the drawings demanded being unnecessary for the immediate purpose ; and that simple illustrations of the apparatus offered would, in the first instance, be amply sufficient to enable purchasers or their engineers to decide as to the tenderer or tenderers to whom they will, in the first instance, give the preference, who could then be required to submit the necessary drawings.

The grievance is, moreover, as it appears, not confined to the tender stage. In the contract stage also, the drawings required are, members submit, frequently excessive in number and variety, and unnecessarily detailed. In the case of motor panels, for example, of which a large number are sometimes ordered at one time, it is not unusual for three or more dimensional prints of each panel to be asked for.

My Council conceive that in many instances excessive demands for drawings may arise from thoughtlessness or lack of knowledge on the part of purchasers' assistants, who habitually, and, perhaps, excusably, make them as a matter of routine with every inquiry or order passing through their hands, specifications usually embodying "covering" provisions as to the drawings which shall be supplied if required.

From whatever cause arising, however, my Council feel assured that a remedy will be found for the grievance, and that, so far as it lies within the power of purchasers to apply it, the remedy will be applied. The interests of both parties are obviously served in the end by keeping down charges for unproductive labour ; and the total amount of drawing-office charges incurred yearly by manufacturers as a body is, under the present system, very large indeed, having regard to the fact that only one or two out of the 20 or more tendering firms can possibly get any order.

D. N. Dunlop,
Secretary, The British Electrical and Allied Manufacturers' Association.

London, W.C., *October 25th*, 1912.

[The practice to which our correspondent refers is one to which we have from time to time drawn attention during the past ten years and more ; there is no doubt that it is, as he says, a source of great expense and waste of labour, and like some other familiar items in specifications, its observance is largely due to tradition. We refer to the matter more fully in our leading columns.—Eds. E.R.]

Generating Plant for Village Lighting.

"Little Man" hardly gives one any important data on which to found an answer to his query. This opinion in a day of highly-efficient internal-combustion engines may seem absurd, but from having advised on a good many such cases during the last few years, I am in a position to state that in many such small plants an examination of the methods of working them generally shows that with very little capital expenditure the output of the plant could be much increased, and the amount of fuel taken to run the increased load be actually decreased. It is not contended that such plants could show the fine results of the up-to-date internal-combustion engines ; that would be obviously ridiculous, but where capital is of such importance, it often results in a cheaply obtained steam plant, or the present plant, slightly altered, being able to suit the financial conditions of the owners better. If with fuel costs at 1·1d. per unit, customers are increasing, it follows that the said customers must be prepared to pay the cost of generating electricity in this fashion, or they would not apply for connection. The problem then becomes not one of extremely low costs per unit generated, but of extremely low capital expenditure per unit of plant.

Why not try running condensing and installing a feed-water heater ? These points alone would allow some extra output at a diminished coal cost, and as the extra power required appears to be very small, it may be that some extra load can be safely carried in this manner if the generator will stand, say, another 2 or 3 kw.

I agree with "Little Man" that such plants are able to fill a demand for electric lighting in out-of-the-way villages, when really modern plant would be too costly for the financial resources of the district.

Such plants are exceedingly interesting, and it is surprising how many such exist, and, above all, how they nearly all seem to satisfy their owners. If "Little Man" will communicate with me through the Editor, I shall be pleased to go into the matter on receiving full particulars of the present installation.

Electric Supply.

I was interested in your correspondent's letter under the above heading, and I think a good many of your readers would be glad of some further information about the small plant referred to, for a great many of these village lighting plants will be erected within the next few years. The question as to the best and most economical plant for such a job could hardly be answered unless one knew the maximum number of lights the plant would ever be likely to be called upon to deal with, but in your correspondent's case, I should think a reliable steam engine would be hard to beat. I am surprised that he does not add a feed-water heater to his plant, as this would certainly mean an economy in fuel. No mention was made of a storage battery, but presumably one is installed. Perhaps your correspondent would say (1) what is the voltage of his supply, and the system ; (2) what he expects as an ultimate maximum load ; (3) the rate per unit charged ; and (4) if the syndicate supplies meters and charges a rent for the same.

I am interested in two or three small village lighting schemes, and should be pleased to reciprocate with any information I can give.

E. J. Williams.

Inverness, *October 28th*, 1912.

Fuse Formulæ.

In a letter in your last issue under this title, Mr. W. H. F. Murdoch refers to a paper which Dr. Russell read before the Physical Society in 1910, and which he appears to have misunderstood.

Dr. Russell proves that if a wire carrying a current be cooled by a steady stream of liquid, flowing in a direction perpendicular to the length of the wire, the current which is necessary to maintain the temperature of the wire a given amount above that of the supply of liquid is proportional to $a^{1\cdot25}$, where a is the radius of the wire. The assumptions made are that no heat is lost by conduction or by radiation, that the cooling liquid is incompressible, and that steady stream-line flow takes place. The theorem has received ample experimental verification.

For wires of small diameter stretched horizontally and cooled by a vertical convection current of air, the above conditions hold approximately. For flat strips they cannot be supposed to be true, nor for short thick wires.

Messrs. Schwartz and James show that the steady current required to raise a fuse wire to its melting-point is proportional to a^n, and that n lies between 1·13 and 1·32, except in the case of larger copper wires, where much of the heat is lost by conduction to the terminals. In the case of aluminium the causes which lead to the ultimate disruption of the fuse are very complicated, but the current required to *melt* the metal is shown to be proportional to $a^{1\cdot27}$.

I am not aware that Dr. Russell claims to have discovered a new law for fuses, but I think he was not far from the truth when he stated that, previously to the appearance of Messrs. Schwartz's and James's paper, electricians were accustomed to estimate the fusing current of a wire by the method which is referred to by Mr. Murdoch as "*the best known*," viz., $C \propto d^{1\cdot5}$. The index 1·25 for wires and cables in air is in excellent agreement with results obtained by Prof. Forbes as far back as 1882 (see *Electrician*, Vol. 9, page 497), and both he and Prof. J. T. Bottomley proved 30 years ago that the 1·5 law was erroneous.

There is no such statement in Dr. Russell's paper as $R = \rho_0/\pi a^2$; the resistance per unit length of the wire is

taken as $\rho_\theta / \pi a^2$, ρ_θ being the volume resistivity of the wire at the steady temperature which it attains. The term "volume resistivity" (as to the meaning of which Mr. Murdoch seems to be uncertain) is defined in any standard book on testing, *e.g.*, Fleming's "Handbook of the Electrical Laboratory," Vol. I, page 252.

F. T. Chapman.

Hendon, *October 28th*, 1912.

Salaries in Canada.

The salaries paid in the electrical business, particularly in central stations, have often, and rightly, been the subject of comment in your columns. I notice, in your issue of September 27th, an advertisement for a switchboard attendant at 7s. 6d. a week. I should like to call the attention of the men in the old country, who accept similar positions, to the wages paid to switchboard men in Canada.

The rate of pay, of course, varies in different parts of the country, but a very fair average is from £3 10s. to £4 a week. In one station that I know of, two out of the three switchboard men are under 21 years of age. One I know to be 19, and he has had one year's experience. He gets £4 a week. Out of this he pays less than £1 a week to the company for board and lodging.

We are told that money is not everything in this life, but a jump from 7s. 6d. to £4 a week is almost worth considering. An increase in salary of over 1,000 per cent.! It sounds almost like the dream of the advertising manager of a correspondence school, nevertheless it is true.

Emigrant.

Canada, *October 19th*, 1912.

[We do not doubt our correspondent's statement, but, to prevent immediate and wholesale emigration, we may point out that the number of switchboard jobs in Canada is not unlimited, and most of them, no doubt, are occupied.—Eds. E.R.]

Commercial Development.

In view of the leading article contained in your issue of October 25th, I think it may be of interest to your readers to know that, whereas the British Commercial Gas Association has sold over 700,000 pamphlets in its first year, the Electric Supply Publicity Committee has sold over 2½ millions in 2½ years.

For reasons which are clearly stated in your article, this is the only field of operation in which the work of the Electric Supply Publicity Committee is open to comparison upon equal terms, but I think it shows that the Committee may be trusted to perform its duties satisfactorily, and I hope that your remarks may have the effect of providing the Committee with further opportunities for activity in the common interests of the electrical industry.

A. F. Harrison,
Chairman, The Electric Supply Publicity Committee.

London, E.C., *October 29th*, 1912.

[And this is—*publicity!*—Eds. E.R.]

Speech Frequency.

It has always been assumed in telephonic transmission calculations that the average frequency or pitch of the human voice is from 750 to 850. There appears to be some doubt as to the basis on which this figure was arrived at, and its correctness. It would be interesting to know, and perhaps some correspondent can say, on what basis this frequency has been adopted.

$2\pi \sim$.

Association of Mining Electrical Engineers.—Mr. Sydney F. Walker, of Bath, has been re-elected for the fourth year in succession as the president of the South Wales Branch of the Association. His presidential address dealt with the introduction of electricity into mines.

THE EMPLOYMENT OF COMMISSION AGENTS.

[by our legal contributor.]

Cases frequently arise relating to the employment of commission agents to travel in electrical goods. The salary or commission paid to a "man on the road" is money spent in a form of advertisement; and it is but natural that the dealer in fittings scrutinises the orders with the same care in order to be assured that the traveller, while making one for himself, is making two for the firm.

The first essential to the proper and efficient working of the travelling or canvassing department is to secure the services of a manager. It will be his duty to select competent and tactful canvassers who will temper zeal with discretion, and exercise such judgment that the firm will not be saddled with a heap of bad debts. How best can such a manager be remunerated? A good man requires a certainty, so a fixed salary is necessary, but to encourage industry, and above all, to make it worth his while to see that his subordinates do their work efficiently, it is advisable to give him an interest in the orders which they secure. That can best be done by allowing a commission or percentage upon the earnings which come in from his department.

It is easy enough to provide in an agreement that a manager shall be paid by salary and commission on the receipts of his department during a certain period; but a bare provision of this character is scarcely sufficient to meet the requirements of a rapidly expanding business. Suppose, for instance, that a man is employed to manage the canvassing department of a business whose travellers visit every town in England and Wales, for a period of five years. The business rapidly extends, and becomes so large that it cannot possibly be worked in its entirety from London. In the result branches have to be established; and a branch cannot be run without a manager. The question will then arise: Must commissions still be paid to the London Manager?

This raises, indirectly, a question of general interest, namely, Is a man who is paid by commission entitled to insist that the person or firm employing him shall so continue the business as to enable him to earn his commission? It may be stated as a general principle that a mere contract to employ a man at a salary imposes no obligation to find employment. If the salary is paid, the employer has done what is required of him. It is otherwise, however, if there is an agreement to pay a commission. In that case a man is entitled to have an opportunity of earning his commission. This may be illustrated by the case of Turner *v.* Goldsmith (1891) 1 Q.B. 544. There the defendant, a shirt manufacturer, by contract in writing agreed to employ the plaintiff, and the plaintiff agreed to serve the defendant as agent, canvasser and traveller on the terms—first, that the agency should be terminable by either party at the end of five years' notice; secondly, that the plaintiff should do his utmost to obtain orders for, and sell, the various goods "manufactured or sold by the defendant as should from time to time be forwarded or submitted by sample or pattern." And it was further provided that the plaintiff should be remunerated by such commission as was specified in the contract. After about two years the defendant's manufactory was burnt down, and he did not resume business, and thenceforth did not employ the plaintiff, who brought an action for damages for breach of contract. It was held by the Court of Appeal, reversing the decision of Justice Grantham, that the action was maintainable, and that the plaintiff was entitled to substantial damages, for the defendant, having agreed to employ the plaintiff for five years, did not fulfil the agreement unless he sent him a reasonable amount of samples to enable him to earn his commission, and that the defendant was not excused from fulfilling his agreement by the destruction of his manufactory by fire.

The mere fact that the payment of salary does not import the right to demand work so as to keep your hand in, was settled in Turner *v.* Sawdon & Co. (1901), 2 K.B. 653. In that case the defendants agreed to engage and employ the plaintiff as their representative salesman for a

period of four years. Before the expiration of that time the defendants, though willing to continue to pay wages to the plaintiff, refused to give him any work to do as their representative salesman. In an action to recover damages for breach of contract, it was held that there was no obligation on the defendants to provide the plaintiff with work. Lord Justice A. L. Smith said :—

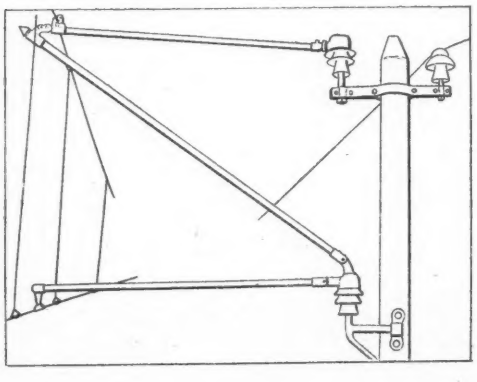
> It is within the province of the master to say that he will go on paying wages, but that he is under no obligation to provide work. The obligation suggested is said to arise out of the undertaking to engage and employ the plaintiff as their representative salesman. It is said that if the salesman is not given employment which allows him to go on the market, his hand is not kept in practice, and he will not be so efficient a salesman at the end of the term. To read in an obligation of that sort would be to convert the retainer at fixed wages into a contract to keep the servant in the service of his employer in such a manner as to enable the former to become *au fait* at his work. In my opinion, no such obligation arose under this contract, and it is a mistake to stretch the words of the contract so as to include in what is a mere retainer an obligation to employ the plaintiff continuously for the term of his service.

It follows from what has been said, that in the case of the manager of a canvassing department his employers could not remove from his sphere of influence any part of the country by the appointment of branch managers. In making arrangements with a manager therefore, care should be taken to make special provision for the expansion of business by the employment of branch managers.

A LIGHT BRACKET CONSTRUCTION FOR HIGH-TENSION TRACTION LINES.

THE "Z" bracket shown in the accompanying sketch is built according to the Giros and Loucheur patent, and is the type exclusively employed on the 215 miles of 10,000-volt single-phase electric railways radiating from Limoges in the Haute-Vienne district. The advantages of the construction include cheapness, lightness, strength and flexibility. The three main members are of gas pipe, and the general method of connecting them to each other and to the insulators on the short brackets carried by the wooden poles is shown in the sketch.

The upper horizontal arm carries at its outer end a 34 sq. mm. stranded steel cable, from which is suspended the contact line (of 80 sq. mm. 8-section galvanised iron), according to the well-known catenary system. The lower



end of the diagonal member and the inner end of the lower horizontal tube are carried from a second pole insulator. The upper horizontal and the diagonal tubes constitute the load-carrying bracket, while the lower horizontal arm simply acts as an "antioscillator." The connections between the tubes themselves and between them and the insulators are jointed, so that the flexibility of the whole suspension is very high.

A special counterweight device is erected on section towers at intervals of 3 or 4 km. along the route, and a uniform tension of 4 kg. per sq. mm. is thus maintained in the contact line. The conductor carried by the insulator on the right of the upper bracket in the sketch is a 10,000-volt bare copper feeder employed to compensate for the pressure drop in the contact conductor. A full description of the generating, distributing and traction equipment of the above system is to be found in a recent issue of *Houille Blanche*.

PURE TITANIUM.

BY WALTER J. ADKINS.

THE problem of how to obtain the metal titanium in a pure state has engaged for a long time the attention of scientists. Many lamp-makers have also been interested in the matter, as it is possible that lamp filaments of high efficiency could be formed from the metal. Pure titanium has been obtained for the first time as a result of the experiments which have been carried out in the Rensselaer Polytechnic Institute, Troy, New York, by Matthew A. Hunter. The most successful attempts to isolate the pure metal which have been made hitherto have resulted in the production of an ingot which contained only 5 per cent. of impurities. Hunter enclosed titanium tetrachloride, $TiCl_4$, in a metallic bomb with pure sodium. The capacity of the bomb was about 1,000 cb. cm., and it was built up out of machined steel parts. It is stated that it was capable of withstanding a total internal pressure of 80,000 lb. When the process is carried out it is said that the reaction inside the bomb takes place so rapidly as to be practically instantaneous, and it should be noted that the chemical action only commences after the steel envelope has been heated to a certain temperature.

It is said that tests made on the metal after it has been obtained in this way in a pure form show that it is hard and extremely brittle when cold, but that if it is heated to a dull red heat it is almost as easily forged as ordinary charcoal-iron. In appearance it resembles polished steel, but does not break with the crystalline structure which characterises the latter metal. Those who are interested in titanium from an electrical standpoint will regret to hear that all attempts made to draw it into wire of even comparatively large cross-sectional area have been unsuccessful as yet, although there is a strong probability that further efforts in this direction will result more satisfactorily. On the face of it the metal should be suitable for lamp-making purposes, as its melting point is approximately 1,800° C., whilst the specific gravity is about 4·5 and the specific heat about ·1462.

Suggested Tests of Motor-Car Electric Lighting Sets.—One of the features of the automobile movement during the past year or two has been the rapid adoption of electricity as the means of illumination for the lamps, and, in the case of covered cars, for the internal lighting. That well-known motorist and motor trader, Mr. S. F. Edge, who has been experimenting for some time with the different car-lighting systems at present on the market, reports that he finds a discrepancy between the relative values of the different systems as driving lights and also between their effective efficiencies. He also considers that most electric lighting sets have not a generator sufficiently powerful to supply the amount of electricity to the accumulators that is taken out of the latter during use, and that with many generators that are sold, one requires to charge the battery during the daytime in order to have sufficient current for use at night; that is to say, the lamps are taking more current out of the accumulators than the generator is putting in. Mr. Edge therefore considers that the time has come for some responsible body to carry out a series of clear and decisive tests. The points on which the trials should be based are, in his opinion, as follows:—

1. The distance at which a dark-clothed pedestrian can be seen distinctly on a dark road.
2. The width of lighting beam at distances of 20, 50, 150, 200, 250 and 300 yards from the car, the test of lighting beam area being the distinct visibility of dark-clothed pedestrians on a dark road.
3. The number of watts available for lighting at engine speeds of 200, 500, 1,000 and 1,500 R.P.M.
4. Prior to admission to the trials, each competitor should be required to state his claims as to the tests enumerated above.

THE MANCHESTER STREET LIGHTING REPORTS.

A VERY interesting series of reports is that submitted jointly, and individually, by Messrs. Haydn Harrison and Jacques Abady, upon the street lighting in Portland Street and Princess Street, Manchester. The joint report, which is the essential portion, reads as follows :—

We beg to report that we are agreed upon the following points :—

1. That for all practical purposes the degree of illumination in Portland Street and Princess Street is approximately equal.

2. That, based upon the figures of costs of current and gas, &c., given us by the respective departments, the arc lamps as used in Portland Street are provided at an annual cost which is less than the gas lamps as used in Princess Street.

3. That, as a comparison between the possibilities of arc lighting and high-pressure gas lighting, the results are vitiated by the fact that the high-pressure gas lamps are giving an efficiency very much below similar lamps when properly installed and adjusted.

The supplementary report by Mr. Harrison states that he has taken the figures relating to the cost of production of the rival illuminants as being correct.

Only four of the 16 arc lamps installed in Portland Street (those nearest Princess Street) have been taken into consideration, in order that a similar number and length of street might be compared with the H.P. gas lamps in Princess Street.

The lamps were operated in the ordinary manner, but a considerable leakage of gas from the H.P. main was not taken into consideration when calculating the gas consumption. In both cases central light sources suspended from span wires were used ; in Princess Street, Keith H.P. gas lanterns, each containing three inverted H.P. mantles supplied with gas at a pressure of 55 to 60 in. (of water), and a small compressor plant, electrically-driven, for compressing the gas, were installed ; while in Portland Street there were Metroflam Magazine Flame arcs, with clear inner globes and partially-obscured outer globes, connected eight in series across 400-volt mains. A tower ladder was used in both cases for trimming, &c., and in this connection, Mr. Harrison draws attention to the lowering gear used in the City of London, which has proved satisfactory in the case of electric lamps, but, in the case of high-pressure gas lamps, often suffers from trouble with the joints.

The gas lamps have an average height of 26 ft. 6 in., and are an average of 107 ft. apart, while the electric lamps are all 27 ft. 6 in. high and an average of 121 ft. apart.

Mr. Harrison arrives at a consumption of 79·5 cb. ft. per hour for each gas lamp, costing for high-pressure gas 1·147d. per hour, which, with the additional cost of mantles, globes, labour, &c., brings the costs up to 1·5d. per hour, which would be increased, as regards maintenance, if the pressure were increased to improve the efficiency of the lamps.

For electric lighting, including the cost of carbons, trimming, maintenance, &c., he arrives at a cost of ·7d. per hour (energy, ·382d.) for all-night lamps, and ·9d. per hour (energy, ·625d.) for half-night lamps.

Taking equal cost, 1½d. per hour would give 1,750 C.P. with gas, and 6,364 C.P. with electricity ; or 2,970 C.P. would cost ·7d. with electricity, and 2·54d. with gas. Two average illumination tables included, are as follows :—

	Princess Street gas lamps.	Portland Street arc lamps.
Candle-power at 20° to 25° ...	1,750 C.P.	2,970 C.P.
,, at 45°	1,670 C.P.	3,170 C.P.
Min. hor. illumination	·39 ft.-candles	·5 ft.-candles
Max. ,, ,, ...	1·9 ft.-candles	2·26 ft.-candles
Conditions after 11.30 p.m.*		
Candle-power at 20° to 25° ...	49·5 C.P.	2,970 C.P.
Min. hor. illumination	·004 ft.-candles	·084 ft.-candles
Max. ,, ,, ...	·7 ft.-candles	2·26 ft.-candles

*Alternate arcs extinguished ; high-pressure gas extinguished, and low-pressure gas lamps used.

The following table gives average results arrived at by Mr Harrison :—

	Princess Street H.P. gas lamps.	Portland Street arc lamps.
C.P. of lamps	1,750	2,970
Lamps per mile	49·34	43·6
Running costs per lamp per hour	1·5d.	·7d. and 9d.*
Capital costs per mile	£2,537	£1,569
Running costs per 1,000 C.P.-hours	0·857d.	·236d. and ·3d.*
Cost per annum per mile, equal illumination	£675	£254 and £314*
Minimum illumination basis of comparison	·39 ft.-candles	·5 ft.-candles
Cost per mile of street per annum (up to 11.30 p.m.) at above illumination	£617	£254 and £314*

* After 11.30 p.m.

The capital costs are taken in the case of gas, for lamps, lanterns, poles, suspension and all accessories, at £50 per lantern ; in the case of electricity, at £36 per lamp with all accessories.

Neither high-pressure gas main and compressing plant, nor series street lighting cable are included, as they have been included in the general charges of each undertaking.

Mr. Harrison adds that the illumination of the two streets, as far as the ordinary observer is concerned, is equal, but that the electric lighting is far cheaper, and even if the gas lamps had been working at double the efficiency, or the cost of electricity been doubled, the electrical method would still have proved the more economical for equal illumination.

Cases of more efficient H.P. gas lamps are found where higher pressure is used, but the Princess Street lamps give results similar to those obtained in other parts of the country.

Mr. Abady reports at greater length on the matter. He finds that the lighting by H.P. gas, in respect to general illumination, quality of light and freedom from involuntary extinctions, is better than the arc lighting ; that the electrical C.P. is superior, and that the arc lamps are highly efficient, while the H.P. gas lamps do not attain normal efficiency.

That based upon the figures of cost supplied by the electricity and gas departments, the latter cannot supply three-burner H.P. lamps at as low a cost as can the electricity department supply 11-ampere flame arc lamps, (he, however, demurs as to the costs, considering that they cannot be safely taken as a basis in estimating for future extension of either systems).

The gas lamps have an efficiency of only 27 candles per cb. ft. of gas, whereas they could with suitable adjustment and pressure reach 50 candles ; and in further extensions he recommends two-burner lamps, 20 ft. above ground and 130 ft. apart.

Subject to his criticism, he considers that the tests justify an extension of both systems, but arc lamps should be used for suspension over tramway routes.

As regards illumination, Mr. Abady finds under the arc lamps a mean of ·88 ft.-candles, and under the gas lamps a mean of 1·46 ft.-candles. Between the lamps he finds for the arcs mean figures of ·252 ft.-candles and ·251 ft.-candles on road and kerb respectively, and for gas, ·279 ft.-candles and ·250 ft.-candles in the same way.

In the case of direct C.P. readings, he finds in the case of the arc lamps, mean, maximum and minimum figures of 2,949, 3,170 and 2,767 candles at 20° S., and 1,478, 1,759 and 1,331 candles at 75° S. ; the comparable gas figures are 2,173, 2,431 and 1,922 candles at 20° S., and 1,558, 1,613 and 1,473 at 75° S. As regards cost, Mr. Abady finds that each arc lamp consumes 600 watts per hour, and each gas lamp 80 cb. ft. of gas in the same time, and he reckons the cost of all-night electric lamps (4,000 hours) at £11 6s. 5d. per lamp per year, or ·68d. per hour lighted, and for half-night lamps (2,000 hours) at £7 18s. 2d. per lamp per year, or ·9d. per hour lighted ; the gas lamps (2,000 hours) cost £11 9s. 2½d. per lamp per year, or 1·37d. per hour lighted.

In regard to capital cost, he finds that the 16 arc lamps in Portland Street cost £873 2s. 10d., inclusive of £306 for cable, while the four gas lamps cost £194 11s. 6d., *exclusive of anything for high-pressure gas mains and compressing plant.*

Mr. Abady then discusses the question of electricity and gas costs, and comes to the conclusion in regard to the former, that as the fixed charge on traction plant at Manchester is apparently £9·357 per KW. connected, while that for lighting and power is apparently £7·525 per KW. connected, that the lighting costs are reduced at the expense of the traction costs ; he further fails to reconcile the charge for traction (no profit) 1d. per unit, 36 per cent. load factor, with the charges of ·682d. per unit on a 45 per cent. load factor for all-night lamps and 1·132d. per unit on a 23 per cent. load factor for half-night lamps, and other minor points are raised such as the necessity of charging the cost of street lighting staff and street-lighting mains to street lighting, although he does not consider it necessary to charge high-pressure gas mains in the same way.

With regard to the cost of gas, Mr. Abady is quite satisfied with the costs taken, but he states that the electricity renewals fund is below proper standard, while the gas department is in an exceptionally strong financial position, also that the latter has during the last 10 years contributed £605,783 in aid of the rates, as against £73,500 given by the former.

He also devotes considerable space to arguments, with a view to showing that the high-pressure gas lamps adopted at Manchester are not so efficient as they, or other types of lamp, could be.

Mr. Abady's report concludes with three appendices, and both his and Mr. Harrison's contributions are well worth close study by municipal authorities who are discussing the question of electricity *v.* gas lighting for the streets.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"CAMP" writes :—"Having connected a new consumer to our mains, after a few days we began to receive complaints from neighbouring consumers to the effect that their lights were unsteady, and on investigation we found that this was due to the heavy and irregular loads thrown on the mains by the new user The latter refusing to install apparatus which did not interfere with the supply to others, we eventually discontinued the supply to his installation, and we are now threatened with an action for damages on the ground that we should either have declined to supply the consumer in the first instance, or that, having commenced supply, we could not discontinue it without giving compensation. Can you refer us to the result of any similar action ?"

*** Before pronouncing a final opinion on this question, it would be necessary to have an opportunity of seeing the documents in the case. It would appear, however, that the undertakers are protected by certain sections in the Electric Lighting Acts. Thus, by Sec. 18

of the Act of 1882, it is provided that while the undertakers may not prescribe any special form of lamp or burner, "No . . . person shall be at liberty to use . . . the electricity supplied them for any purpose, or to deal with it in any manner so as to unduly or improperly interfere with the supply of electricity supplied to any other local authority, company or person by the undertakers, and if any dispute or difference arises between the undertakers and any local authority, company or person entitled to be supplied with electricity under this Act, or any . . . order . . . as to the matters aforesaid, such dispute or difference shall be determined by arbitration." The Electric Lighting Clauses Act, 1899, Schedule Sec. 27 (4), goes further, and confers the right to cut off the supply. It provides that: "If the owner or occupier of any such premises as aforesaid uses any form of lamp or burner, or uses the energy supplied to him by the undertakers for any purposes, or deals with it in any manner so as to interfere unduly or improperly with the supply of energy to any other body or person by the undertakers, the undertakers may, if they think fit, discontinue to supply energy to those premises so long as the lamp or burner is so used, or the energy is so used or dealt with." It will be seen from this that even if the worst comes to the worst, "Camp" only has to fear an arbitration. To an action which might possibly be brought for breach of contracts, there appears to be an absolute statutory defence. The position of the undertakers will, of course, be unassailable if it is provided in the contract that the supply is furnished under and in accordance with the provisions of the Electric Lighting Acts. "Camp" would be well advised to consult a lawyer conversant with electrical matters. So far as is known, there is no report case on the questions he propounds.

"Flat Rate" asks:—"In the case of a company supplying electricity to a district under Parliamentary powers, can it enter into a contract with a large (or any) consumer to supply him for a stated sum per annum, instead of charging for consumption by a meter?"

*** It is clear that undertakers have power to enter into a special contract to supply power to any consumer provided that they do not show him undue preference. The question whether they show him a preference is determined by taking all the circumstances of the case into account. In one case a consumer agreed to take the whole supply required for his premises from the plaintiffs for not less than five years, paying 4d. a unit. It was alleged that there were other contracts with other consumers in existence, less favourable to those consumers. Mr. Justice Buckley interpreted the section thus: "It appear to me that the relevant words here are 'under similar circumstances to a corresponding supply.' There is left a latitude to the company making bargains with its customers where circumstances differ, or the supply does not correspond for different terms. How far they may go is a question of degree. The facts are that Gates (who had entered into a contract for two years at 4d.) is a very large consumer—his bill is stated to be 10 times that of the defendant. Moreover, he is a customer who burns largely upon the day load as distinguished from the night load, a circumstance which is to these companies of great importance. They are bound to keep their plant running in the day as well as in the night, to some extent at least, because some consumers want current during the day; and to get a customer who draws upon the day load is of use to them, because they are getting some return for running plant during hours which otherwise would be unproductive. May they take that into consideration? I answer, certainly they may. The 'circumstances' are not 'similar' where the one consumer is on the day load and the other is on the night load.

"Then what does a 'corresponding supply' mean? Does it mean that you are necessarily to treat the small consumer upon equally advantageous terms with the large consumer? The cost to the company may be very different, greater uniformity of demand, easier and less expensive collection of the amount to be paid are circumstances to which regard must be had." (See Metropolitan Electric Supply Co. *v.* Ginder (1901) 2 Ch. 799).

Tramcar Accident.—On Friday, last week, the inquest was concluded at Mitcham on the body of a boy named Alfred Allen Ward, of Leyton Road, Wimbledon, who was killed in a collision between a tramcar belonging to the South Metropolitan Electric Tramways and Lighting Co., Ltd., and a van, near Tooting Junction. The driver of the car, Walter Ducie, of Croydon, was arrested and charged with manslaughter, and was present under remand at the adjourned inquest. Evidence was given that the road was dark at the spot, and that the van was showing no light. The driver applied both brakes, and the result was that the boy's body took all the effect of the blow, the van escaping almost without damage. It was stated that if there had been only a foot more between the two vehicles no accident would have occurred. The evidence of Mr. A. V. Mason, general manager and chief engineer of the Tramways Co., was taken on the question of brake power. He said the car weighed 8 tons, and was fitted with hand and power brakes. The latter worked by short-circuiting the two motors, and, if applied in conjunction with the sanding of the metals, the car could be pulled up under ideal conditions in 30 ft. After making tests, however, he was doubtful whether a car could be pulled up in much less than 20 yards on the receipt of a sudden and unknown signal. The jury returned a verdict of "Accidental death," thinking that the evidence was not strong enough to warrant one of "Manslaughter" against the driver.

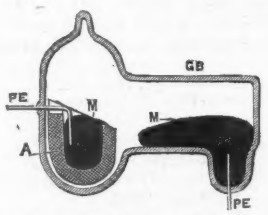
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Mercury Switch.

It has long been known that an electric current of considerable voltage may be broken between mercury surfaces in an atmosphere of hydrogen, without an arc of serious dimensions being formed. The heat generated is remarkably small. Of late years such interrupters, consisting of small glass tubes with sealed-in platinum electrodes, partly filled with mercury, have been tried for many purposes, without, however, giving complete satisfaction. It has been found that they are apt to crack or even to explode after a while, or the mercury becomes dirty.

Two causes have contributed to these defects. The tubes have been made cheaply and hastily, and under such circumstances a considerable number will leak at the sealing-in of the wires. They may be leaky when they leave the blower's hands, or they may develop minute cracks later as a consequence of strain set up in the glass on cooling. In filling them such defects are not usually discovered, as they must be in the analogous case of vacuum tubes. After a while, oxygen gets in from the air, and an explosion may ensue, or the mercury gets oxidised when breaking of current takes place. In any case, the glass gradually deteriorates, probably owing to electrolytic action, at the point where the spark occurs, and finally cracks at this point after the tube has been in use for some time.

The mercury break illustrated herewith, when properly manufactured and tested, is stated to be free from these defects, and to be indestructible. The tubes are given a special annealing treatment, and are tested for airtightness and strain in the glass. The spark of break is taken up on a small porcelain cup A in the figure. The illustration is full size for 10 amps.; 500 volts are broken with certainty. How rapidly the break may be repeated depends upon the nature of the circuit; once a second is not too much on a load of incandescent lamps. The inventor and patentee is Mr. H. Stafford Hatfield, who is having the switches made in small quantities under his supervision; his address is Technische Hochschule, Brunswick, Germany.



G B, glass bulb; M, mercury; P E, platinum electrodes; A, porcelain cup.

Fig. 1.—Section of Hatfield Mercury Switch.

A Prometheus Toaster.

The British Prometheus Co., Ltd., of Salop Street Works, Birmingham, have introduced a new toaster, which is extremely neat in appearance, and is light and readily handled. The construction is simple and owing to the entire absence of solder and the abandonment of the "double case" construction which has hitherto been followed the toaster should prove to be durable, and able to stand the use of breakfast room and kitchen alike. The elements are of a new type, and while ensuring the correct distribution of incandescent rays, permit the resistance itself to be

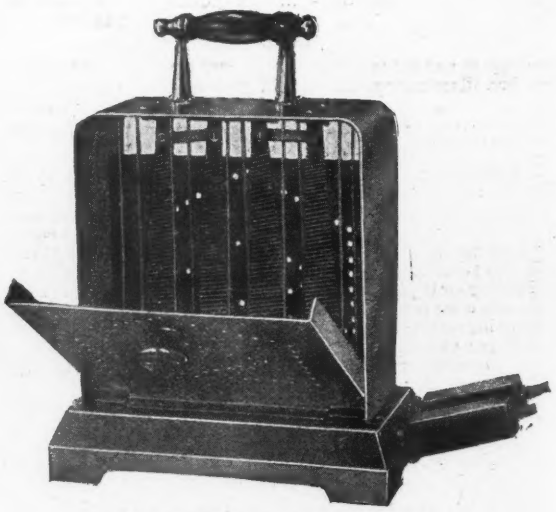


Fig. 2.—A Prometheus Toaster.

mounted in the most favourable manner possible. The bread, it is claimed, is toasted evenly over the whole of the surface, and it will be noticed that the doors are perforated to allow for the escape of moisture. Moreover, the doors are mounted so as to act as bread carriers, which will pull outward and downward, and they can be readily removed for cleaning purposes. The elements themselves are mounted in such a way as to afford every facility for renewal.

A.C. Motor-Starting Pillar.

We illustrate in fig. 3 a recent addition to the standard ironclad control gear—Type D.F.C.—made by the General Electric Co., Ltd. This combination is for the starting of squirrel-cage motors by means of an auto-transformer starter shown at the bottom of the panel. An interlock device is fitted on the latter, which makes it necessary for the operator to move to the "start" position before he switches on to the "run." On the panel are also mounted an ammeter in a water-tight case, an interlocked main

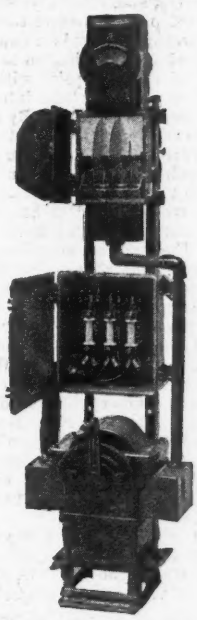


Fig. 3.—A G.E.C. Switch Pillar.

switch and a separate three-pole fuse box. It will be noticed that all connections are run in screwed conduit. The whole pillar is liberally designed, and its rugged construction may be inferred from the fact that a 15-H.P. size weighs 420 lb. net. We understand that the General Electric Co., Ltd., are now specialising in the manufacture of starters for single-phase motors

"Eclipse" Electric Heaters.

One of the most promising features of recent progress in electric heating is the willingness of makers to guarantee the durability of their apparatus, thus proving that the old complaint of unreliability can no longer be levelled against electric heating devices. The Electric and Ordnance Accessories Co., Ltd., of Cheston Road, Aston, for instance, now give a guarantee for five years with their convector heating elements. A variety of new designs have been placed on the market by this firm, two of which

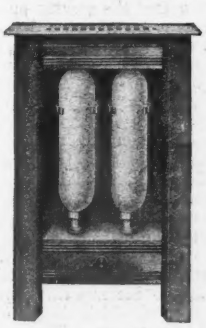


Fig. 4.—Portable Radiator.

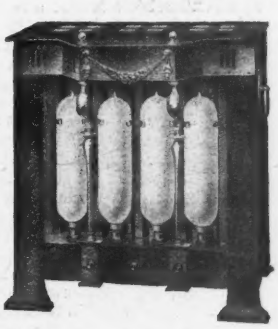


Fig. 5.—Combined Convector and Radiator.

we illustrate herewith. Fig. 4 shows a very inexpensive glow lamp radiator, of polished rolled copper steel, with polished copper reflector—a light and portable type. Fig. 5 is one of a series of combined convectors and radiators, in the "Sheraton" style, of antique dull brass; this is provided with three switches, and consumes, full on, 2½ units per hour. This type combines the advantageous features of both the convector and the luminous radiator, while either system can be used separately at pleasure.

B.T.-H. Mazdaliers.

The British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, E.C., have introduced a new kind of fitting, called the "B.T.-H. Mazdalier." Two main considerations have been kept in view in the design of the Mazdalier—convenience in handling, storing and installing, and the provision of the most effective lighting results. Mazdaliers are convenient in the sense that they are supplied to the contractor packed in neat pasteboard cartons, which can be easily stocked on shelves. Every fitting is absolutely complete, with holders, galleries and wiring, and therefore the expense and trouble of installation are considerably lessened. The cartons, moreover, protect the fittings from dust and oxidisation. Mazdaliers are supplied in square and round tube types, for single lamps, or with two, three, four or five arms; and in two finishes, cloister (a rich oxidised copper) and brushed brass (a dull brass finish).

They can be easily and rapidly fixed, and made ready for service

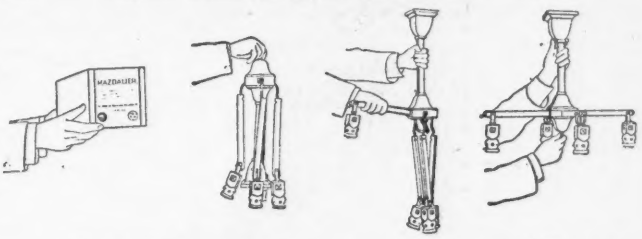


Fig. 6.—Mazdalier in Carton; as it Appears when Removed and Method of Building it up.

in a few minutes. The list prices cover holders and galleries, all completely wired—everything, in fact, but reflectors and lamps; and for a trifling capital outlay, and in a small showroom, a contractor can hold a large and varied stock of these compact fittings. Amongst other advantages, it is pointed out that by stocking a few of these fittings the contractor is in a position to execute experimental or temporary installations with a minimum of damage to the fittings and trouble to himself; and in shops, offices, houses, &c., whenever it is necessary to remove fittings, Mazdaliers can readily be taken down, packed in cartons, and stored, and kept in good condition until required. The prices of the fittings are so low that they can be used advantageously in place of cord clusters

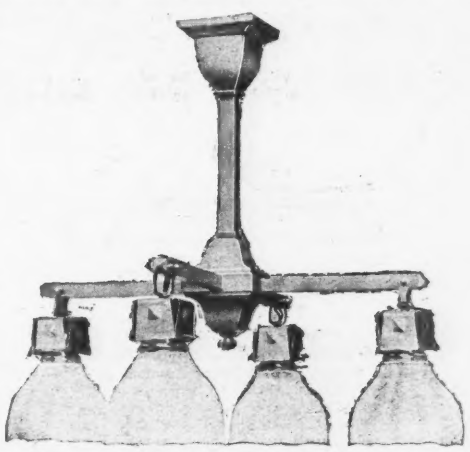


Fig. 7.—A B.T.-H. Four-Light Mazdalier.

The development of these fittings represents another stage in the B.T.-H. Co.'s "Good Lighting" campaign. First, the company placed the Mazda lamp on the market; next, they turned their attention to the provision of scientific and artistic reflectors, such as the Veluria and Holophane; finally, they have produced the Mazdalier fitting described above. By the supply of these lighting appliances, and with the assistance (in an advisory capacity) of the company's Illuminating Engineers' Department, the company claims that the contractor is enabled to meet every requirement of scientific and satisfactory illumination.

G.E.C. Cooking Devices.

The General Electric Co., Ltd., have brought out some additional cooking apparatus recently; this includes a breakfast set consisting of a hot-plate, a 1½-pint kettle and a 1½-pint saucepan. A neat little holder for four eggs is provided for the miniature saucepan. All the utensils slide on to the hot-plate, so that they cannot be accidently knocked off. Further, the "sliding-on" principle ensures the closest contact between the heating element and the utensil, thus making the appliance highly efficient in operation.

Another novelty is an electric teapot, so designed that after the water in the vessel has been heated by electricity to the boiling point, and the tea has become of the desired strength, the enclosed teaball, which holds the tea leaves, can be drawn up into the lid of the teapot. The capacity of the teapot is two pints, and it consumes 350 watts.

New G.E.C. Circuit-Breaker.

The General Electric Co., Ltd., have recently introduced a small circuit-breaker for A.C. and D.C., suitable for small motors, heating circuits, and other situations where fuses are inconvenient, which is to be known as the "Junior Salford" pattern. It corresponds in finish, design, and simplicity, to their "Standard Salford" and "Senior Salford" types, which at present range from

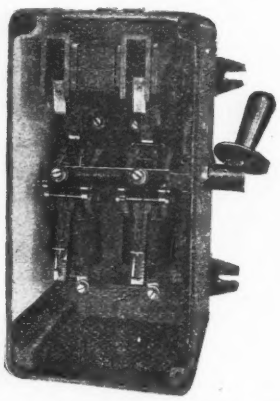


Fig. 8.—G.E.C. Junior Salford Enclosed Circuit-Breaker.

30 to 5,000 amperes, and upwards. The breaker will be made in various sizes from 5 to 50 amperes, in single, double, and triple-pole combinations, with overload or no-volt coils, and in open or enclosed type. The last named, which we illustrate in fig. 8, will have a cast-iron water-tight case complying with the Home Office requirements and Mining Regulations. The freehandle principle has been retained, while the closing handle acts a tripping device when it is required to open the circuit manually.

Insulating Shoes.

The St. Helens Cable and Rubber Co., Ltd., of Warrington, have sent us a sample of their new patent insulating shoe, which, as illustrated in fig. 9, consists of a golosh of ordinary type with crossed rubber ribs vulcanised upon the sole, the heel and the instep. The ribs do not add materially to the weight of the shoe, but considerably increase the safety of the user, for the amount of wear is very distinctly visible on the raised surface of the ribs, whereas it is difficult to tell how far it has affected a flat sole—

Fig. 9.—St. Helens Insulating Shoe.

especially as wear takes place inside the shoe as well as outside. An adjustable ankle strap enables the shoe to be worn on various sizes of foot over the boot, of course, with comfort. We have also received a sample of their cab-tire faced insulating mat, consisting of a sheet of insulating rubber faced with a layer of cab tire, which protects the former and greatly prolongs the life of the mat.

BUSINESS NOTES.

Consular Notes.—Italy.—The British Consul at Naples reports that, although the concession for a metropolitan electric railway was granted to a local concessionaire only on January 12th, 1912, the negotiations for it had been progressing for some considerable time previously to this. The Société Franco-Italiana des Chemins de Fer Metropolitains de Naples, of Paris, is financing the scheme with an initial capital of 16,000,000 fr. The Naples office is in Galleria Umberto Primo. The line is to be 8 km. long in the town and is to have branches to neighbouring villages. There are to be from 13 to 15 stations in the town, with lifts and stairways to the outer surface. The greater part of the urban section will be underground. It is hoped to inaugurate the line within five years. Very little progress has been made with the execution of the scheme for the harnessing of the forces of the Volturno River for industrial purposes. Much difficulty has arisen from conflicting and competing interests. The Minister of Public Works has received the report of the Special Commission appointed by him to study the industrial and economic development of Calabria, especially with regard to the construction of three vast reservoirs in the Sila district. The projected works would seem to be of exceptional importance, and their execution of no great difficulty, owing to the formation of the land and its adaptability to be converted into vast artificial lakes. The three basins are to develop together a force of more than 160,000 H.P., which should provide ample power for electric light, traction, tramways and railways in Calabria, Basilicata and Pugia, as also for any other important industries which may be created on the spot. Furthermore, the water collected will serve to irrigate large tracts of the surrounding country, and, finally, by storing up the water, it would be possible to develop the course of the river Neto, on which project the State has already proposed an expenditure of £250,000. These extensive works, which are estimated to cost some £2,500,000, are to be executed by private enterprise without any intervention on the part of the Government, whose intention, however, is to further the scheme as much as possible. By the execution of this vast programme enormous advantages would accrue to the provinces of Calabria, where the present Minister of Public Works has already increased the railway mileage by some 600 miles.

Mexico.—The British Consul at Tampico reports that the concession for an electric tramway system has recently been acquired by British capitalists, and active work in construction will be started immediately. The same company have also purchased both of the existing electric light plants, and intend constructing a central power station for the lighting of the city, as well as for operating the electric tramways.

The Vice-Consul at Monterey reports that the Cia. Telefonica y Telegrafica Mexicana have owned and operated the telephone system in that city for upwards of 20 years under a Government concession which gave the company a monopoly. This concession having been modified, however, a new company, composed of native capitalists, and called the Nueva Telefonica de Monterey, has been formed, and is now engaged in installing its plant, wires, &c. It is expected that the competition of the two companies will give Monterey a cheaper and more efficient service than was formerly enjoyed. Both companies are placing their wires in the centre of the city in underground conduits.

The British Consul at Mexico City reports that, during the latter half of 1911, 541 km. of new Federal telegraph wires were strung in different parts of the Republic, and three wireless telegraph stations, viz., at Vera Cruz, Campeche and the Island of Madre Madre (off the coast of Tepic) were opened to the public. A direct telegraph service was inaugurated between Payo Obispo (Quintana Rooderista) and Corozal, in British Honduras, thus connecting the telegraph system of that Colony with the Mexican Federal system.

Norway.—The British Consul at Christiania reports that at the Christiansand Nickel Refining Works, where nickel is obtained electrically by Hybinette's method, the production in 1911 was 285 tons nickel, and 80 tons copper. The works have been extended to produce 600 tons nickel and 80 tons copper per annum. The Christiansand Works are taking over the Ringerike Nickel Works, and intend to refine the matte at Christiansand. The Norwegian export of calcium carbide in 1911 was about 60,593 tons. The cyanamide factory at Odda exported 13,172 tons, as compared with only 4,250 tons in 1910. The export of ferro silicon amounted to 5,745 tons. Electrothermic zinc exports amounted to 46,573 tons, chiefly from Sannesund, near Sarpsborg, but also from Trondhjem, mostly from imported raw zinc. There are two Norwegian aluminium factories at Stangfjord, and near Christiansand; their export is estimated at about 1,019 tons, or about the same as in 1910. The Norsk Hydroelektrisk Kvœlstofaktieselskab is stated to have acquired the greater part of the interests formerly held in the Rjukan companies, for the production of saltpetre, by the Badische Anilin and Soda Fabrik, and the chief administration of the concerns at Notodden and Rjukan has been taken over by the head offices of the first-named company at Christiania. Dealing with the Odda Works, the British Vice-Consul at Bergen points out that the cyanamide company (North-Western Cyanamide Co.) has increased its output of calcium cyanamide from 12,000 tons to about 15,000 tons per annum, the bulk of which is shipped to Germany, but considerable and steadily increasing quantities are sent to the United Kingdom and the British Colonies. The work has now been taken over by a a new British company, and the production is to be further extended up to 73,000 tons. The calcium carbide works of the Alby United Carbide Factories, Ltd. (who also own a factory at Meraker, near Trondhjem), are likewise arranging to increase their output from 30,000 tons to 80,000 tons per annum, of which about 56,000 tons are to be taken by the cyanamide company. The carbide company use about 20,000 H.P. from the electrical power station of the Tyssefaldene Co., but this will shortly be increased to about 56,000 H.P. The manager of the Tyssefaldene Co. is not resident in this district, but it is understood that the company own a small plant for the production of metallic alloys, and have had under consideration a proposal for the installation of a large plant for the electrical smelting of zinc. The eventual capacity of the power station is estimated at over 100,000 H.P., and is now being extended to a capacity of 84,000 H.P. In the three factories mentioned a considerable amount of British plant has been introduced. Dealing with electrical developments at Notodden, the British Vice-Consul at Skien points out that there are three factories for saltpetre,

carbide of calcium, electric smelting, &c. The electric power available is about 60,000 to 70,000 H.P., obtained from the Svœlgfos, Tinfos and Lienfos waterfalls. Proposals are also on foot to harness a fall above Hiteraal so as to obtain electric power and transmit it to the Skien Fjord. If the idea is carried out it will mean an undertaking which will cost several million kronor. The municipal power works at Samnangar were nearly completed at the end of 1911, and were to supersede the present steam power works at Bergen in March last. The three turbines, one of which is to be kept in reserve, will develop a power of 3,500 H.P. each, and it is proposed later on to add others up to a total of 1,700 H.P. The machinery is entirely of Norwegian manufacture. The steam power station will be kept for reserve in case of emergency.

In view of the expansion of the use of electricity in Norway the remarks of the Vice-Consul at Bergen on British trade and the methods adopted by manufacturers are particularly interesting. He points out that whereas only 84 licences to British commercial travellers were issued in 1911, 352 were issued to German travellers. These figures require no comment. There are, however, distinct signs that British merchants have, within the last year or two, begun to show greater energy than formerly in pushing their business in Norway. In view of this increased interest, it might be suggested that British business managers and partners who wish to develop their trade with Norway might perhaps with advantage follow the example of some of our commercial rivals by undertaking personal visits in the country with greater frequency than now appears to be the case. Cases are known where this method has been attended with great success in other parts of the world, and more than one business man in Bergen has told the Consul that he would certainly feel more disposed to do business with a firm if he were in occasional personal relations with its head. Such a visit should be stimulating to resident agents, and need not interfere with the regular work of the firm's travellers, to which it would be supplementary. A knowledge of Norwegian, though, of course, a great advantage, would not in most cases be indispensable, provided German were spoken as well as English. It may, perhaps, not be out of place to point out that, in view of the attractions which the west coast of Norway offers to the tourist, a holiday might thus be made profitable as well as enjoyable, even if it were not thought worth while to come out for business purposes only. Local merchants, for the most part, take their holiday in June or July, and are in Bergen during August and September. Amongst the lines of business in which the United Kingdom does not appear to be getting her fair share of the business, one of the most noticeable of late has been electrical appliances. Although the resources of the country in water-power are still to a great extent undeveloped, the use of electricity is very general, and it would appear that the proportion of orders placed in the United Kingdom is relatively insignificant.

Japan.—The British Consul at Yokohama reports the trade in electric lighting, power and tramway plants there was steady during the year 1911, there having been a constant increase in existing plants and a considerable number of new undertakings brought forward. A difficulty, however, is that in most cases long terms of credit are asked for, which do not appeal to the manufacturer. The total value of electrical machinery imported in 1911 was £237,000. The increase in favour of gas-driven plants calls for passing notice; both producer plants and suction-gas plants are inquired for. A feature of interest is the growth of water-power schemes in all parts of the country. Orders seem to be going mostly to Germany and to America. There has been a good demand for power and lighting cables for underground use, and the heavier and higher-tension cables are still ordered from abroad, but low-tension and the smaller cables are being made more and more in Japan under protection afforded by the tariff. Aerial and ordinary lighting and telephone wires are practically all made in Japan, the lead-covered cables only being imported.

Dealing with the tramways of Yokohama, the Consul points out that considerable extensions are now (1912) being made to the existing system, bringing outlying districts into close touch with the town. The work has been accompanied by much levelling and filling in of ground for building purposes, and whatever the actual prosperity of Yokohama, to the outward eye the city appears to be growing steadily. The following figures give the population and number of houses in recent years:—

	Population.	*Houses.*
1907	379,000	75,000
1908	393,000	78,000
1909	407,000	82,000
1910	420,000	84,000
1911	444,000	88,000

Allowance must, however, be made for the incorporation within the city limits of districts formerly outside. This amalgamation last year amounted to 12,000 persons and 2,000 houses.

The British Consul at Kobe, in a recent report, states that it is satisfactory to note that the fear expressed in some quarters that, on account of the revision of the tariff and the basing of some duties on the net weights, the importation of British machinery would show a serious falling off, was not realised in 1911. In comparison with Continental and American goods, however, British machines are, generally speaking, heavier, and therefore liable to higher rates.

The new tariff appears on the whole to work smoothly; but in certain cases it is extremely difficult for importers to calculate the duty when making up tenders, as in certain instances it is assessed partly on the net weight of the goods and partly *ad valorem*. Switchboards and railway trucks may be mentioned as instances of this. The demand for electric traction plant in 1911 was brisk. The Ranzen Electric Traction Co. placed orders for machinery; the Osaka municipality for rolling stock and air brakes; the Hiogo Electric Railway Co. for sub-station machinery and rolling stock; and the Keishin and Okayama Electric Railway Companies for high-speed engines and generators, boilers and rolling stock. Gas engine-driven stations for lighting and power were, as a rule, fitted with British plant, but German makers secured several orders by under-cutting British prices. Amongst important contracts for British machinery may be mentioned the contract for the equipment of the Kawasaki Dockyard in Kobe. The smaller town gas engines and suction gas plants are being made in Osaka in fair numbers. Large quantities of electric motors are made in Japan, but orders are still being placed in America, Germany and Italy, British prices being as a rule considered too high. Several thousand fan motors were imported from the three countries above-mentioned, and here again British machines are ruled out on account of price. Cables of all descriptions are largely made in Japan, though several orders have gone abroad. The demand for cables of the underground description is increasing as the tendency is to insist on high-tension cables being laid underground in the chief cities instead of being erected on poles overhead as heretofore. The Osaka municipality, the Kyoto municipality, the Kobe Electric Railway Co., the Osaka Electric Light Co. and the Ujikawa Hydroelectric Co. were large purchasers of cables during the period under review. For machine tools British makers secured several important contracts.

A demand has arisen for electricity meters, and large orders have been secured by a British firm. Recently, however, a very light type has been introduced from America and the Continent, and as the duty is assessed on the net weight of each instrument, our commercial rivals will probably secure more business in future. As regards water power stations, the Hiroshima Water Power Co. may be mentioned as having bought a large plant of British manufacture, and orders were placed for the Oita Hydro-Electric Co. for Continental machinery. This latter company is situated in Kyushin, but the orders were placed in Osaka. Incandescent lamps are made in enormous quantities in Tokio and Osaka—both carbon-filament and metallic—and imports have consequently declined. The steam turbines ordered by the Nankai Railway and the Kobe Electric Light Co. were seized on arrival for infringement of patents controlled by a large American company having works in Tokio, and although the importers were finally allowed to deliver them, the case is still pending in the Courts; consequently, British and German builders are hesitating to take orders.

During the year 1911 two serious scandals were brought to light. In one case the directors of an electric railway company were arrested for embezzlement of the company's funds, and in the other an electric railway campany repudiated a contract given to a British firm for British machinery, and the machinery was left on the hands of the importers. The Japanese Commercial Code was revised in October, 1911, and with ordinary precautions, such a case as the latter will not happen in future. During the year under review the Osaka Electric Light Co. placed a very large order for switchboards with a German firm. Two or three British houses tendered, but, as the German tender was much more detailed than the British ones, the latter were not seriously considered.

There has been a notable increase in the number of cases of extended terms of payment, and as British merchants as a rule do not care for this class of business, many orders were lost to our manufacturers.

The British Engineers' Association.—The Secretary has sent us the following particulars relating to this new Association:—President—Mr. Douglas Vickers. Vice-Presidents—Sir Robert Hadfield, F.R.S.; Mr. Herbert Marshall; Sir William Mather, P.C., LL.D.; Mr. C. C. Scott; Sir John I. Thornycroft, LL.D., F.R.S. Chairman of Executive Committee—Mr. Wilfrid Stokes (Ransomes & Rapier, Ltd.). Other Members of Council—Messrs. *H. Allcock (W. T. Glover & Co., Ltd.), A. Anderson (Edward Wood & Co., Ltd.), *T. O. Callender (Callender's Cable and Construction Co., Ltd.), W. Collingwood (The Vulcan Foundry, Ltd.), *Percy B. Crowe (W. H. Allen, Son & Co., Ltd.), F. R. Davenport (Willans & Robinson, Ltd.), *W. H. Dixon (Hadfield's Steel Foundry Co., Ltd.), *J. Cunningham Ford (T. Cooke & Sons, Ltd.), G. B. Hunter (Swan, Hunter & Wigham Richardson, Ltd.), Stainer Hutchins (The Power-Gas Corporation, Ltd.), Edward Jackson (Midland Railway Carriage and Wagon Co., Ltd.), Christopher James (Joshua Buckton & Co., Ltd.), H. Norman Leask (Heenan and Froude, Ltd.), *R. S. Lloyd (Hayward-Tyler & Co., Ltd.), Howard Marsh (George Fletcher & Co., Ltd.), Charles S. Schultz (Dick, Kerr & Co., Ltd.), *Arthur H. Smith (Holman Bros., Ltd.), T. Cuthbert Stewart (Stewarts & Lloyds, Ltd.), Philip Thaine (Vickers, Ltd.), John E. Thornycroft (John I. Thornycroft & Co., Ltd.), *Thomas Woof (Alfred Herbert, Ltd.). (Members of the Executive Committee are shown by an asterisk.) Honorary Members—Mr. Byron Brenan, C.M.G., late Consul-General in China; Sir Charles Dudgeon, one of the Commissioners for the Revision of Commercial Treaties with China; Sir Walter Hillier, K.C.M.G., C.B., late Adviser to the Chinese Government; Mr. Claude Kinder, C.M.G., the creator of the Chinese Railway system; Dr. George Ernest Morrison, newly appointed Adviser to the Chinese Government.

A Birmingham Supplies Business.—As we announced in our issue of August 30th, the METALLIC SEAMLESS TUBE CO., LTD., now have the headquarters for their electrical supplies business at Meta House, Corporation Street, Birmingham, a very central position. The building is one of six floors, two being devoted to a fittings showroom and general office accommodation, and four being used as stock rooms. The premises were opened in consequence of the need for additional premises due to increased business in elec-

trical accessories, cables and lamps. In the showrooms there are varieties of electroliers, brackets, standards, &c., from which customers of the trade in the Midlands can make their selections. The stock-room floors are specially fitted up with every facility for the handling of goods. Each floor is 100 ft. long, running right through from Corporation Street to Newton Street; the goods and trade entrance is situated at the latter end. The top floor is devoted exclusively to lamps, shades, battery jars and other glassware. On the third floor general lighting accessories are stored, and on the ground floor conduit and conduit fittings, while in the basement there are cables, flexible cords, jointing materials, &c., as well as the trade counter. A goods lift serves all floors.

Book Notices.—"Les Canalisations Isolées." By J. Grosselin. 1912. Paris: Gauthier-Villars. Price 3 fr. 75 cents.

"*Bulletin* Mensuel de la Société Belge d'Electricité." August, 1912. Brussels: The Society. Price 1 fr. 75.

"Wechselstrom-Arbeitsdiagramme." By Emil Waltz. 1912. Berlin: Hermann Meusser. Price M. 22·50.

"*Transactions* of the Institution of Civil Engineers of Ireland." Vol. XXXVIII, 1911-12. Dublin: The Institution.

"*Boletin* de Ingenieros." Vol. III, No. 1. September 16th, 1912. Mexico: Secretaria de Guerra y Marina.

"*Bulletin* of the Imperial Institute." Vol. X, No. 3. October, 1912. London; John Murray. Price 2s. 6d. net.

"*Journal* of the South African Institution of Engineers." Vol. XI, No. 3. October, 1912. Johannesburg: The Institution. Price 2s.

Catalogues and Lists.—The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—Net price list of 600-megohm grade rubber cables, of which large stocks are held at their London stores.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Leaflet No. 680, containing illustrated particulars of "Flexume" day and night electric signs, Aston "Midget-Lamp" signs for theatre service, and "Aston-Drum" double-sided illuminated swing or fixed sign.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—Booklet containing a full illustrated description of the construction and use of their new "Lumograd" instrument for the measurement of illumination. Copies will be forwarded on application.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—New catalogue, No. 537, giving very complete information respecting their dry cells, dry cell batteries, &c. A finger index separates sections relating to Obach dry cells for general purposes and for ignition, also Hellesen dry cells, Dura cells, and transport cells. Prices and general instructions are given. A separate leaflet describes and shows the Siemens "Satchel" electric lamp.

Messrs. Siemens Bros. Dynamo Works, Ltd., 38 and 39, Upper Thames Street, London, E.C.—Price list No. 15 (20 pages), containing full illustrated information, with prices, dimensions, weights, &c., of electric hand and bench drilling machines, grinding motors and accessories.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Folder relating to, and giving prices of, Osram drawn wire battery lamps for omnibus, motor-car and yacht lighting. Also a copy of the 10th edition of Section "H" of their catalogue relating to electric heating; this is a 16-page price list showing a variety of designs of luminous radiators, zig-zag luminous radiators, convectors, Bastian Quartzalite convectors, non-luminous heaters for ship, train and tramcar service, "Magnet" flat irons, electric kettles, and "Robertson" heating lamps

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Two leaflets illustrating aluminium bus-bars and connectors, and aluminium coils.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—Mailing card concerning their breakfast cooker and grill.

The British Westinghouse Electric & Manufacturing Co., Ltd., Long Millgate, Manchester.—An attractive little folder (envelope series 4150/A), entitled "Kill the Chill," giving a few notes and prices of their convector and luminous radiators; also leaflet relating to Westinghouse horizontal gas engines.

Messrs. Drake & Gorham, Ltd., 66, Victoria Street, London, S.W.—New catalogue, consisting of some seven sections. The first of these, of some 32 pages, contains illustrations and very plainly indicated prices of incandescent lamps (Osram, Wotan, Mazda, Metfil, Tantalum, carbon filament, both English and foreign, "turn-down" lamps, &c.); the second section, devoted to arc lamps, includes Butt flame lamps, enclosed lamps, photographic lamps, cinematograph lamps, resistances, &c.; the third deals with cables and flexibles, jointing materials, &c.; the fourth (switchgear and lighting accessories) describes circuit-breakers, instruments, lamp-holders, wall plugs, switches, and a number of "Home Office" accessories; electric heating and cooking apparatus occupies the next section, Bastian, D.G., Price's, the Archer and Economic systems all being included, as well as lamp radiators; Holophane glassware occupies the next 16 pages; and the last section of all consists of 60 pages of illustrations and prices of electric light fittings of all kinds.

Schiersteiner Metallwerk, Schwerinstr. 3, Berlin, W., 57.—Leaflet describing a relay with enclosed mercury contacts for weak currents.

Allgemeine Elektricitats-Gesellschaft, Berlin.—Set of leaflets illustrating and describing the A.E.G. quick-break switches, motor switch panels switch cases, &c.

The Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—Eight-page illustrated list (No. 7,028), giving prices and data of the lamps used in their "Eye-Comfort" system of inverted, indirect and semi-indirect arc lighting, also resistances for same. The "Kandem" arc lamp suspension gear is also particularised.

The Brompton and Kensington Accessories Co, Ltd., 254-260, Earl's Court Road, Kensington, London, S.W.—24-page catalogue containing excellent illustrations, brief particulars and prices of the "B. & K." "Universal Electrical Home Needs." These include electric toasters, shaving-water heaters, flat-irons, electric kettles, boiling rings, tea-ball teapot, coffee percolators, coffee urns, chafing-dishes, &c. The company has been organised by the Brompton & Kensington Electric Supply Co., and it is introducing appliances which are the product of many years' experience, and which may be inspected at its showrooms. This catalogue is the first of a series to be issued by the company. Later ones will deal with cooking, heating and ventilation.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—The new catalogue of this company which has just been received, if it were worth its weight in gold would figure out substantially, for it is a solid volume of more than 500 pages of enamelled paper. It consists of 20 sections, with sectional divisional leaves to each, with printed tabs to facilitate reference. The opening pages contain a description of the company's works, and alphabetical and numerical indexes, also a particularly useful telegraph code. Coming to the sections, we think we shall find it somewhat difficult to select all the items from so vast a variety that should have mention, so we had better adopt a simpler method and state the sections, adding at the same time that, of course, any one of the sections can be obtained separately. Section "T," conduits and fittings and tools; "U," Simplex flexible wiring system, lead-covered wiring; "D," distribution boards, switchgear, enclosed fuses and fuse wire; "M," watertight fittings for mills and ships, also steel reflectors, &c.; "W," wires and cables for lighting, bells, and telephones, &c.; "A," accessories; "B," electric bells and telephones; "P," porcelain insulators; "L," metal-filament lamps; "V," fans and small motors, drilling machines, &c.; "H," electric heating appliances; "C," electric cooking appliances; "E," automatic electric lighting plants; "S," electric signs and stage lighting appliances; "I," instruments, ammeters, and voltmeters; "Z," electricity meters; "F," electric fixtures; "G," shades, glass and silk, Spookie shades; "R," Holophane glassware, vacuum cleaners, and sundries. As will be gathered, the contents cover all kinds of installation apparatus, with the exception of large machinery and generating plants. In addition to being of direct service to the trade, it is recommended for hanging in contractors' premises for reference by consumers. There is a substantial increase in the size of the catalogue in comparison with that issued a couple of years ago. Prices are as far as possible set out in tabular form. The firm are also issuing a small 24-page booklet, dealing with electric heaters and convectors, of a convenient size for the pocket or for enclosing with correspondence. This booklet is an abridgment of their large heating catalogue, and contains all the latest designs; some 50 different patterns are shown altogether. Supplies of these booklets may be obtained by contractors or central station engineers interested, overprinted with their names and addresses. A novel departure has been introduced by the company in making all the prices quoted for radiators inclusive of internal wiring between the switches and holders, such internal wiring being in every case brought to two substantial screw terminals mounted on a special bridge piece fixed to the inside of the case, so placed that it cannot be accidentally touched. Special flexible for use with these heaters can be obtained protected by wire armouring without extra cost, and a special form of wall socket has been designed for use with the armoured flexible.

Messrs. E. Bennis & Co., Ltd, Little Hulton, Bolton.—16-page pamphlet, containing a full descriptive account of their patent high-temperature coking stoker and patent self-cleaning compressed-air furnace, its construction and operation. Reports of tests of boilers fitted with these stokers are given.

Messrs. Hinchcliffe, Green & Co., Aire Street, Leeds.—Advance leaflet, giving description and tabulated prices of their single-phase squirrel-cage motors, for the manufacture of which they have equipped their works with up-to-date machinery. Copies of the list will be sent on application.

Messrs. Baxendale Bros., 96, Whitechapel, Liverpool.—A special net price list of electrical accessories is being issued to-day.

Messrs. Bergtheil & Young, Ltd., Finsbury Court, Finsbury Pavement, London, E.C.—Binding cover containing a number of lists (No. 50) detailing the "Bandy" variable-speed S.P. A.C. motors, for lift or crane service, giving tabulated prices, weights, &c.; also diagrams of connections, test curves; drum type reversing controllers; half-tone views appear of the motors applied to crane and pumping work.

Trade Announcements.—Mr. Harold Jaggar announces that he is continuing at Commercial Street, Batley, the business of Messrs. H. Jaggar & Co., electrical engineers.

Messrs. Hutton Bros., electrical engineers, of Swindon, have, owing to increased business, taken the Quantock Works, Devizes Road, which they will open early in November, on completion of the necessary alterations.

Messrs. Doulton & Co., Ltd., are purchasing the goodwill and connections of the business of Messrs. J. Stiff & Sons, Lambeth, as from December 25th, 1912. Messrs. J. Stiff & Sons will discharge all their liabilities accruing to that date and will collect accounts in the usual course.

Liquidation.—Direct Gas Fuel, Ltd.—This company is winding up voluntarily, with Mr. A. W. Good, of Moorgate Station Chambers, E.C., as liquidator. A meeting of creditors is called for November 11th.

Electrical Trade with New Zealand.—The report of the British Trade Commissioner for New Zealand, in referring to the preferential tariff, states that the same goods which the Dominion is trying to keep out by higher duties in the interests of the United Kingdom, are being pushed in by British shipowners through lower freights granted on German and American goods, and the deliberate policy of the Dominion is thereby being frustrated. As the idea is prevalent that preferential duties apply to all imports, or at least to all classes of goods where there is serious competition from foreign countries, the report points out that in 1910 two-thirds of the total value of competitive imports came in under tariff items where no preferential duty exists, these including tools and a considerable portion of electrical goods. Among the commodities imported under the preferential section of the tariff, mention is made of motor and bicycle lamps, there being a considerable purchase of American electric lamps, which is no doubt influenced by the very large importation of American motor-cars. The imports of electrical machinery increased by £25,000 to £132,000 in 1911, and the share of Great Britain rose by £22,000 to £76,000, or from 50·5 per cent. to 57·6 per cent. In the case of gas and oil engines, the value expanded from £90,000 in 1910 to £129,000 in 1911, the British share having advanced from £66,600 to £104,000, and the balance being practically all of American origin. The British share of steam engines in 1911 was £8,354 out of a total of £9,203. Referring to the question of public works, the report states that the development of water-power is a matter of some importance. At the time of writing, tenders were being invited in connection with a large scheme for using the energy from Lake Coleridge for the supply of electricity to Christchurch and vicinity. Other proposed schemes are the utilisation of the Wairoa Falls for Whangarei, and also of Lake Waikaremoana. The development in these cases is not likely to be rapid, as the Government policy is to keep these matters under State control. The report is a comparatively short one, but the general advice given in it should be particularly valuable to those who wish to promote trade with New Zealand.

LIGHTING and POWER NOTES.

Acton.—In the friendly arbitration between the U.D.C. and the Metropolitan Electric Supply Co., Ltd., Mr. H. H. Collier has been appointed valuer, to act on behalf of the Council in the matter of rental to be paid by the company for certain lands referred to in the agreement, the preparation of which has been left in the hands of the clerk and solicitor.

Algeria.—The municipal authorities of Khenchela are considering a scheme for the establishment of a central electric lighting station in the town.

Barking.—The Electricity Committee has decided to increase all scale charges for current for power purposes by ½d. per unit.

Barnsley.—Some inconvenience was caused on Thursday evening, last week, when, at about 11 o'clock, there was a sudden failure of the electric light, the cause being, it is said, the violent collision of a taxi-cab with a fuse-box at the bottom of New Street. The service was restored within the hour.

Bispham.—As the Council is able to provide more electricity than its own district requires, it is proposing to obtain powers to supply lighting in the adjoining districts of Cleveleys and Thornton. The formal consent of Thornton Council is now being sought.

Brentford.—A mains extension to Brentford End has been decided upon by the Heston-Isleworth Electricity Committee, in order to supply current to the new offices and works which have been erected on the east side of the Grand Junction Canal.

Bradford.—The Corporation's electricity undertaking is in a flourishing condition, and on the past year's working a net profit of £8,052 is shown. For private lighting purposes 94,771 units more than in the preceding year have been sold, the bulk consumers have received 679,659 more than during the previous 12 months, whilst smaller consumers who require current for motive power and heating purposes have purchased 500,840 more units than a year ago. Owing to the increased output the total working costs per unit have decreased in spite of the higher price which has had to be paid for coal.

Burnley.—The Electricity Committee has considered the charges for electrical energy for power purposes, and has made the following changes: For the first 39 hours' use per quarter of maximum demand, 1¾d. per unit; all units above that amount, 1d.; where the consumption is equal to or above 400 hours' use per E.H.P. per quarter, ·9d. per unit flat rate; where it is equal to or above 500 hours, ·8d.; where it is equal to or above 600 hours, ·7d. Existing consumers will come on to the new scale at the end of the quarter. The Committee has been empowerod to make special charges to any consumers who will guarantee an annual consumption of 100,000 units of energy or more for a day load.

Bushey.—The U.D.C. has been asked by private persons to allow the E.L. mains to be extended to Bushey Heath, owing to the high price of gas. The matter has been referred to the E.L. Committee.

Caldy (near West Kirby).—The Wirral R.D.C. has decided to have Caldy village lighted by electricity.

Canada.—The Civic Power and Light Department of the City of Winnipeg is now considering the necessity of enlarging the capacity of the power house, owing to the rapid industrial development of the city, and the consequent demand for power. For the coming Spring it is recommended that two extra units be installed. The Department is now getting 95 per cent. of the new business of the city in competition with private corporations, which before the completion of the municipal plant last year, enjoyed a monopoly of the supply of light and power.

Seven hundred farmers of the township of Yarmouth, Ont., have applied to the Hydro-Electric Commission for power. This is significant; the Canadian farmer of the present day runs quite a lot of machinery, and some kind of power is indispensable. The gasoline engine now supplies this power, and its use has become general, but it appears that electricity is to have the preference.

Cheltenham.—The revenue account of the electric light undertaking shows that the receipts for the last year, inclusive of a balance of £3,644 from the previous year and £1,409 transferred from reserve fund, amounted to £28,793. The ordinary outgoings totalled £10,416, interest on loans took £4,775, and instalments in repayment another £3,877, while £3,672 was transferred to sinking funds. The balance in hand at the close of the year was £5,599, or an increase of £1,955. The number of units sold was 1,867,559, in the proportions of 658,501 for public lighting, 584,547 to private consumers, and 624,511 for traction. As compared with the previous year the increase was 94,341 units.

Continental Notes.—Austria.—During the month of August last, 36 projects for the utilisation of water power in different parts of Austria were submitted to the State Hydrographic Department in Vienna. During the same period 24 concessions were granted in respect of previous applications, the intention in the majority of the cases being to utilise the water-power in the generation of electrical energy for lighting and power purposes.

A large power station, described by the *Oest. Wasserwirtschaft*, is projected on the Danube, with a view to completely utilising the unappropriated power of that river for the production of electricity. The preliminary labours are so far advanced that an outline of the scheme is possible. It is intended to construct a low-pressure station, whose average capacity will be 135,000 H.P., and its highest 150,000 H.P., the electric current generated being destined for the use of the capital; and, with a view to independence of the variable water-level, the station will work in connection with the projected large station at Krems-Kamp. The constructive works comprise the building of a movable weir, of such a character that at high water it will offer no hindrance to navigation. This weir, it is considered, will take three years to build. A canal, 12 km. long, will conduct the water to the power house, and serve as a fairway for shipping. Its least waterflow will equal 50,000, and its greatest, 130,000 cb. m. per hour. At the end of the canal a lock for the shipping will be constructed, 200 m. long and 22 m. broad. The power house will be built to accommodate 18 Francis turbines. The whole of the constructive works are expected to be completed within the three years. In the opinion of our contemporary the installation, in its gigantic proportions, will place the greatest power stations of the world in the second rank.

Russia.—A new electricity generating station, for the supply of current for lighting and power purposes, was put into operation in Odessa on October 10th.

The factories in the Moscow district are rapidly adopting electricity as the motive power. According to a recent report, 20 out of the 48 establishments in the Lefort quarter of the city are now electrically driven.

Finland.—A large electricity generating station, with a capacity of about 2,000 H.P., is about to be established by Messrs. A. Ahlstrom and Co., of Norrmark, owners of large saw and paper mills in that town. The electrical part of the plant is to be supplied by the A.E.G.

Coventry.—At the meeting of the City Council on Tuesday, it was decided to spend £1,000 out of revenue upon the purchase of electric motors. The opinion of the Electric Light Committee was confirmed—that it was desirable that, in the event of a Bill being promoted in the next session of Parliament, a clause should be inserted to authorise an extension of the area in which the Corporation is empowered to supply electricity.

Dorset.—An effort is being made to form a County of Dorset Electric Supply Co. The share capital is given as £75,000, and 51,000 shares of £1 each are offered for subscription at par. The towns it is proposed to serve are Dorchester, Sherborne, Wimborne, Swanage, Blandford, and Lyme Regis.

Chile.—Plans and estimates submitted by Mr. George Kenrick for the erection of a central electric generating station for the purpose of supplying electrical energy to the town of Talcahuano and the suburbs of Morro, El Arenal and San Vicente have been approved. Twelve months are allowed for carrying out the work.

Dromore.—The promotion of an electric lighting scheme advanced another step at a special meeting of the Urban Council. The clerk read a letter from Mr. John Hamilton, offering a generating station site, with a lease for ever or for a term of years. There was a mill race in connection with the premises capable of supplying water for eight months in the year, and sufficient space to erect additional plant to supply motive-power for the remaining four months of the year. After a discussion, it was decided that the clerk should write to Mr. Hamilton, asking his terms. Mr. Burns suggested that buying out the gas company might be cheaper in the end. The chairman said, by adopting this scheme, they were agreed that electric lighting was cheaper. The engineers advised that £2,000 would be enough to spend the first year, and the present lighting of the town was costing £150 a year. The entire scheme would not cost more than £2,000. The clerk was given authority to obtain a provisional order.

Dudley.—The sale of the Corporation's electric light undertaking was again discussed on Thursday in last week, at a meeting of the local Traders' Association. In this instance the chief speaker was Councillor H. W. Hughes, chairman of the Corporation Electrical Committee, who contended that as the result of the sale the ratepayers would have returned to them every penny that the undertaking owed, they would be recouped for losses in the past years, and the existing rates for power and light would not be increased. The suggestion to retain the power station involved the provision of extra capital amounting to £23,000, plus a certain increase in the price of current to the tradespeople. The meeting passed a resolution declining to either recommend or condemn the sale of the electricity undertaking, but placing on record an opinion that much of the present difficulty in which the Electrical Committee finds itself is due to neglect and mismanagement.

Dundee.—The consumers connected to the Corporation mains are taking advantage of the cheap rate charged for heating and cooking, and a large number of radiators, hot plates and irons are now being used by them. An industrial laundry has been equipped with 15 electric irons, as well as motors for driving the various machines, and several fans have also been fitted.

East Cowes.—The U.D.C. has decided to invite the E.L. Committee to tender for public lighting, and to quote for the wiring and lighting of the Town Hall.

Eastbourne.—The Electricity Committee has decided to invite tenders for the supply of a number of new flame arc lamps to replace the present ones which are of an obsolete pattern. The engineer estimates the saving in consumption of current, after providing for the extra cost of carbons and interest on outlay, at £222 per annum.

Eccles.—The electrical engineer has been instructed to submit an estimate of the cost of removing the existing arc lamps on the tramway centre poles in Church Street, and providing and fixing on each centre pole a cluster of four metal-filament lamps.

Edinburgh.—Some time ago the T.C. agreed to obtain an estimate for the lighting of the Calton Hill by electricity. It has now been decided to get an estimate of the cost of high-pressure gas. The result will be awaited with interest in view of the Manchester report, referred to elsewhere in this issue.

Gravesend.—With reference to the application of Mr. Castle, of Northfleet, for a supply of current to his new cement works, the T.C. has decided to grant the request, subject to a proper agreement, with guarantees, being entered into. The capital expenditure necessary to give the supply is estimated at £6,200.

Greenock.—At its meeting on Monday, the Corporation decided unanimously to ratify the agreement with Port Glasgow T.C. regarding the supply of electricity for power and light to that burgh. It was arranged that an arbitration clause should be inserted in the agreement; Provost McMillan, who referred with satisfaction to the end of the long-drawn-out controversy, said it was probable that Port Glasgow would soon have a supply of electricity for all purposes, and that this would be to the interests of both towns.

Haslingden.—At the T.C. on October 24th, the chairman reported that application had been made to the L.G.B. for sanction to borrow £5,250 for the provision and laying of new mains, house services, &c. It was decided that authority be asked at the L.G.B. inquiry that the loan be so increased as to afford a supply of electricity to Helmshore.

Heston—Isleworth.—In a report to the Electricity Committee, Mr. Percy Rycroft, electrical engineer, says that some 18 months ago, 72 irons were purchased for distribution amongst various consumers. This stock has now been exhausted, and recent letters from consumers have shown that the irons were very much appreciated and were freely used. The original irons cost 7s. 6d. each, and he estimates that every iron in moderately active use represents a revenue of about 10s., in addition to such apparatus being an effective and reliable introduction for other apparatus, such as radiators, cookers, &c. For a further supply of 100 irons, Mr. Rycroft has now received a quotation from the manufacturers of 5s. 6d. for the 4 lb. size, and 7s. for the 6lb. size, and he advises the Committee that this should prove a very good investment.

Heywood.—In consequence of the illness of Mr. A. A. Day, the Bolton electrical engineer, the Heywood Electricity Committee, has decided that Mr. S. J. Watson, electrical engineer to the Bury Corporation, be requested to give a report on the whole of the undertaking of the electricity works, and that a fee of 25 guineas be paid, such payment to cover all necessary attendances by him on the Committee.

The Electricity and Tramways Committee has made arrangements with the Burns Ring Spinning Co., Ltd., and Messrs. T. Isherwood & Co., Ltd., for the supply of current for power purposes.

Hove.—The local Ratepayers' Alliance has discussed at length the proposal to municipalise the Hove electric supply undertaking and passed a resolution condemning it, and requesting the T.C. not to proceed any further in the matter.

Ilford.—At the last meeting of the U.D.C., Councillor Philpot, speaking on the balance-sheet of the electricity undertaking for the past year, stated that the Council had had another successful year, and were carrying forward £1,600 to their reserve fund—an increase of £200 over last year. Their revenue had increased by £1,293, and their expenditure by £769, but included in the latter amount was £582 for the discounts that had been given for the prompt payment of accounts. By carrying forward £1,600 to the reserve and depreciation account, they raised that fund to £10,500, this being their actual cash reserve, which, with freehold land and premises, brought up the total value of the reserve to £11,890. The gross profits for the year amounted to £14,493, and they had generated 4,000,000 units.

India.—The first modern high-tension electrically-driven flour mill erected in India was recently started by Mr. A. M. Monteath, President of the Calcutta Chamber of Commerce.—*Indian Textile Journal.*

Ipswich.—St. Helen's School is to be lit by electricity, and the Education Committee has decided to allow Messrs. Mann, Egerton & Co. to tender for the installation in opposition to the Corporation electricity department.

Leigh (Lancs.).—The L.G.B. has sanctioned the borrowing by the Council of £2,511 in connection with the electricity undertaking.

London.—Marylebone.—The B.C. has agreed to extend the ½d. rate (on the telephone system) for cooking, to business premises under contract for lighting as from Christmas, 1912, and they will also be allowed, as an alternative to the existing rate, to have electric heating at ½d. per unit on payment of an addition of 20 per cent. on the primary charges under the telephone system, this to take effect as from October 1st.

St. Pancras.—Application is to be made to the L.C.C. for sanction to borrow £13,780, made up as follows:—Machinery, £5,914; mains, £5,240; services and switches, £2,005; meters, £621. The Electricity Committee has decided to insure the undertaking against loss of profits in case of fire for a period of one month, at a premium of £21 per annum, less 15 per cent.

Loose.—The Maidstone T.C. has asked the P.C. to be allowed to tender for public lighting by electricity. A supply is available from the tramway mains.

Oldham.—By a large majority the T.C. has decided in favour of a recommendation of the Electricity Committee that application be made to the B. of T. for sanction to an extension of the electricity mains beyond the municipal boundary, in order to supply energy to drive a cotton mill in the adjoining township of Chadderton.

Peterborough.—The Corporation had received the sanction of the L.G.B. to the borrowing of £500 for service extensions, and application is to be made for a further sanction for £1,000 for new mains.

Rickmansworth.—The U.D.C. has decided to protest against any of the roads in the rural area being broken up for the laying of E.L. mains, under an order being applied for by the Watford U.D.C.

Salford.—An agreement is to be entered into with the Guardians for a supply of current for lighting purposes to the several institutions under their control within the borough. The agreement covers a period of 10 years, and provides that the charge per unit shall be 2¼d. Agreements are also to be entered into for supplies of energy with Messrs. Gatley, Vickers & Co. and Edward Wood & Co., Ltd. In the former case the company is to guarantee a minimum consumption of 50,000 units per quarter, at a price of ·8d. per unit for the first 50,000, and ·7d. in excess of the 50,000, these rates to be allowed on condition that the company uses either high-efficiency, metallic-filament or flame arc lamps throughout the works. The latter firm is to agree to a minimum of 400,000 units per quarter, and to pay an all-round price for current consumed for lighting and power at a flat rate of ·85d. per unit, based on the price of coal being 10s. per ton. A coal clause is inserted in each agreement.

Sevenoaks.—The newly-formed Electricity Co. has asked the R.D.C. to consent to the proposed application for a prov. order, which will include the rural parishes of Shoreham and Halstead. The Council has deferred its decision.

Stoke-upon-Trent.—It is expected that the formal opening of the new central power station at Hanley will take place about the middle of November. The site of the works, which were completed some weeks ago, is near Hanley Park.

Shotton.—Efforts are being made to carry out a scheme of E.L. for the district in conjunction with Hawarden and Queensferry. Particulars of the cost, &c., have been prepared by Mr. Dutton, of the Sandycroft Foundry, and a meeting of the ratepayers is to be called to consider the project.

South Africa.—The Harrismith (Cape Province) T.C. has under consideration the adoption of a hydro-electric power scheme in connection with the main water supply from Platberg Mountain. The scheme provides for an output double that of the present coal-driven electric light station, and also for practically an unlimited supply of day power for industrial purposes.

Swanage.—The B. of T. has deferred for three months the question of revoking the E.L. Order, 1906, held by the U.D.C.

Truro.—The T.C. has decided in favour of the Corporation applying for its own prov. order for E.L. Similar applications are being made, as has been intimated in the Electrical Review by the Gas Co., Mr. Pressland, of London, and Dr. Purves, of Exeter.

Uruguay.—The Bill creating a State monopoly of electricity supply and traction has now become law. By it the State is authorised to establish power stations where required, and to acquire by expropriation or by purchase the present existing undertakings in several towns in the interior, the Monte Video undertaking having already been acquired. Says the *Times* correspondent:—The creation of this monopoly means, in effect, the closing of the door upon all private enterprise in an important and appropriate field; and as the Government most certainly has neither the capital nor the administrative resources to meet the rapidly-growing requirements of the country in this direction, it also means a rude check to its progress. Traction, I may add, did not appear in the original draft of the Bill, but was included at the last moment in committee, no one knowing anything about it until the clause had been approved. This inclusion creates a formidable obstacle to future enterprise in the establishment of electric tramways and railways, for the Government is most certainly not in a position to supply electric energy for these purposes. The Bill is one of the fruits of President Batlle's Socialistic idea that all services of a public character should be performed exclusively by "the State," and as the present Chambers are entirely under his control, the idea is being given legislative authority, regardless of consequences.

Walthamstow.—The charge for current supplied to the tramways undertaking during the current year has been fixed at 1¾d. per unit. The electrical engineer has been instructed to report as to the cost of controlling the whole of the electric street lamps in the district by means of automatic time switches, and as to the saving which would be effected.

Watford.—A L.G.B. inquiry was held last week into the application of the U.D.C. for a loan of £12,938 for additions to the electricity station, and the provision of cables for three years. There was no opposition.

Witham.—Steps are being taken to form a local company at Witham for the purpose of establishing an E.L. undertaking, with a nominal capital of £6,000, of which £4,500 will be called up at once. Messrs. Crompton & Co., Ltd., who have taken the initial steps in the matter, feel that the time is now ripe to inaugurate an E.L. undertaking in the town.

Wolverhampton.—Application is to be made to the B. of T. for a provisional order for supply within an area comprising the parish of Bushbury, and repealing the powers contained in the Midland Electric Power Distribution and Lighting (Extension) Order, 1900, as confirmed by the Electric Lighting Orders Confirmation (No. 7) Act, 1900, as far as regards the parish of Bushbury.

TRAMWAY and RAILWAY NOTES.

Australia.—According to the *Morning Post*, Mr. Hay, an English expert, who was appointed by the Government to investigate the traffic problem of Sydney, recommends the construction of a bridge to connect Sydney with North Sydney, so as to relieve the ferry congestion, and a system of underground electric railways for the city and the suburbs. The total cost of the work, exclusive of the bridge, is estimated at £4,500,000.

Barnoldswick.—In connection with the scheme for connecting Barnoldswick with Gisburn, by a light railway about 4½ miles long, at an estimated cost of £60,000, a Committee of landowners and manufacturers has been formed to take the matter in hand. It is proposed to apply to the Light Railway Commissioners for an order authorising the raising of the necessary capital, and the work of constructing the railway.

Chester-le-Street.—A deputation from the Council which waited upon the Gateshead Electric Tramways Co. with the request for an extension of the motor-'bus service from the tramway terminus at Wrekerton, through New Washington to Washington Village, was informed of the company's willingness to provide it, as there were already on order more motor-'buses than would be required for the proposed Low Fell to Chester-le-Street service.

Chile.—Plans submitted by Don Macario Ossa Cerda for the construction of an electric railway between Santiago and Valparaiso, passing by way of Curacavi and Casa Blanca, have been approved. The actual construction of the line must be completed within 14 months.

Continental Notes.—Austria.—The Austrian State Railway authorities have decided to establish a plant for the utilisation of the water power of the River Ill, near Nenzing (Vorarlberg), in the generation of electrical energy for traction. It is estimated that about 5,700 H.P. will be available.

France.—The estimate of £168,344 for the construction of the tramway projected between Grenoble and Villard-de-Lane has been sanctioned by the Conseil Général of the Departement of the Isère. —*La Lumière Electrique.*

A scheme is at present under consideration for the construction of an electric railway between Lourdes and Mauleon in the Basses Alpes.

Germany.—Official sanction has been accorded to the scheme for building a series of electric tramways between Mörs and Rheinburg in the Rhineland. The Rhenish-Westfalischen Electricitäts-Werke are carrying out the undertaking, which will cost over £100,000.—*Elektrotechnische Nachrichten.*

Spain.—An electric tramway scheme, due to a suggestion of King Alfonso, is in course of realisation to connect Segovia with La Granja. The engineer, Rafael Brenosa, nominated by the King, has completed the surveys for the permanent way, and is now engaged in planning the site for the hydroelectric station on the River Valsain. The line is intended for goods as well as passengers, and will thus stimulate the industrial prosperity of the districts passed through.—*Electron.*

Switzerland.—It is reported that the power station at Bardonnechia, erected for the electrification of the Mont Cenis tunnel, has been destroyed by an explosion and fire. The damage is estimated at £80,000, and the accident will indefinitely postpone the electrification of the tunnel.

Italy.—Plans are being prepared in respect of a projected electric tramway between Feramo and Porto S. Giorgio.

It is proposed to convert the steam tramway between Pisa, Pontedera and Navacchio-Calci to electric traction.

Dunfermline.—Mr. George Balfour, chairman of the Dunfermline and District Tramways Co., and several of his directors, have had a conference with the Town Planning Committee with regard to the tramway provision for the new territory in the neighbourhood of Rosyth. At one time, it was expected that the old Grange Road, which leads directly from the centre of old Dunfermline to a point near Rosyth Dockyard gates, and over which the company have running powers, would have been widened for tramway purposes. Now, however, it is stated that the main road which is likely to be chosen will be a new highway having an approach farther to the west. On behalf of his company, Mr. Balfour is said to be seeking powers which members of the Corporation value at from £20,000 to £40,000. No final adjustment was arrived at between the parties at last week's conference, but to the demands of the Council representatives, it is stated, Mr. Balfour is not willing to accede.

Edinburgh.—At its meeting last week the Tramways Committee considered a motion by Councillor Robertson, advocating the expediency of the Corporation itself taking over and working the tramway system after the expiry, in 1919, of the present lease of the Edinburgh and District Tramways Co. The Committee agreed to recommend the T.C. to adopt a resolution to this effect.

Elland.—The result of the plebiscite on the tramway question was made known last week. Nine questions had been asked the District Council, three having reference to Huddersfield and the remainder in connection with Halifax. There was a poll of 80 per cent. of the electorate, 2,285 votes being cast; 2,134 were in favour of the Huddersfield system, and only 112 against. For paying a subsidy to Huddersfield rather than miss the tramways 1,432 voted in favour and 688 against. In favour of the Halifax system there were 1,536 votes, against 644; 1,977 voted against a subsidy being granted to Halifax and 154 in favour of the subsidy. Only 264 votes were cast for giving a subsidy to Halifax, even if Elland missed the tramways thereby, while 1,829 were in direct opposition.

Halifax.—An agreement has been entered into between the Corporations of Brighouse and Halifax as the result of which the Halifax tramway system will be extended to the Sun Inn, Rastrick, a distance of two miles. One condition laid down by the Halifax Corporation is that Brighouse shall oppose the proposals of the Huddersfield Corporation to bring its tramway service along another route into the centre of Brighouse. Included in the arrangement is the widening of the Halifax gauge between Bailiffe Bridge and Rastrick from 3 ft. 6 in. to 4 ft., which will permit of a connection being made with the Bradford service at Bailiffe Bridge.

A conference has taken place between the Halifax and Bradford Corporations to discuss through-running arrangements between Halifax and Bradford, and Bradford and Brighouse.

Indian Railway Electrification.—From an Indian contemporary we gather that *pourparlers* are now passing between Sir George Clarke and the Administration of the Bombay, Baroda and Indian Peninsula Railways and the Bombay Port Trust, with a view to obtaining expert advice generally on the system of electrification to be adopted on all the Bombay suburban lines worked by these three bodies, the expenses of the investigation to be shared between them.

In sanctioning a scheme for rebuilding Colaba Station, the Bombay Government has laid down a condition that the railway south of Dadar Junction, at least, must be electrified, and this has brought matters to a head. At the end of 1910, Mr. Alfred Dickinson, consulting engineer to the Tata hydro-electric scheme, looking into the prospects of electrifying the Colaba-Bandra section, the power to be obtained from the Tata works.

Liverpool.—Presiding at the final meeting of the Tramways Committee for the municipal year, Sir Chas. Petrie announced that the first nine months of the present year had proved a record. Passengers numbered 99,903,672, an increase over the same period in 1911 of 4,130,330, or 4·3 per cent.; mileage was 9,349,669, representing an increase of 114,238, or 1·2 per cent.; receipts totalled £469,026, an increase of £22,237, or 5 per cent.; and earnings per car-mile were 12·04d., or an increase of ·43d. Having regard to the satisfactory receipts, which indicated that the public appreciated the service during the experimental period, the Committee decided to continue the running of the first-class cars on the Garston and Pierhead, the Croxteth Road, Calderstones Park, West Derby, Knotty Ash, and Aintree and Pierhead routes. The experimental period, which expired on September 26th, in connection with first-class cars on the Litherland and Lime Street route, had been extended for three months, but on the Wavertree route it had been discontinued owing to lack of support.

London.—The directors of the Metropolitan and G.N. and City Railways have notified an agreement whereby the former will take over the latter line as a going concern as from June 30th next.

The Central London Railway has also officially notified its intention of applying for Parliamentary powers to extend its line into the Thames Valley.

At the resumed and final B. of T. inquiry into the collision on the G.N. and Piccadilly Railway at Caledonian Road Station, the evidence of the motorman, who had sufficiently recovered to attend, was heard. According to him, the signal was off, showing a green light. The company's evidence is to the opposite effect, and neither was corroborated.

Scarborough.—In moving, at the meeting of the T.C., the adoption of the minutes of the Streets and Buildings Committee, Mr. F. A. White referred to an interview with representatives of the Railless Electric Traction Co., Ltd., as to the establishment in the borough of a system of railless cars, and hinted that the present tramway company would most likely be helped out of its dilemma.

Swansea.—The General Purposes Committee has received a verbal report from Mr. Selon (London), the tramway expert called in to advise as to running a tramway up Mount Pleasant and over Town Hill, with a view to the development for building purposes of the large Corporation estate. The gradient up Mount Pleasant is about 1 in 8, but Mr. Selon said that a perfectly safe electric tramway could be constructed, and recommended that at the top of the hill one branch should run along and join the Sketty terminus of the existing system to the west, and another branch extend to join the Carmarthen Road section of the existing tramways to the east. He was asked to send in a written report in time to enable the Corporation to apply to the Light Railway Commissioners for a provisional order to carry out the scheme.

TELEGRAPH and TELEPHONE NOTES.

The Balkan War.—The *Times* states that the representative of a wireless telegraph company has arrived in Belgrade to make arrangements with the Servian Government for erecting wireless stations in the newly-occupied towns, and providing a service between the allied Balkan armies.

Home-Made Telephones.—Farmers in the Temiskaming district, Northern Ontario, have just purchased three tons of wire to string between the farms, so that they can always be in telephonic communication one with another. They will cut the poles out of their own bush, dig their own post-holes, string their own wire and be their own electricians; and, lastly, own their own service. This is but following the example of other farming communities in Ontario, with a strong desire to get some of the advantages of civilisation without paying city prices for them.—*Financier.*

Imperial Wireless System.—The Select Committee appointed to inquire into the Marconi agreement with the Postmaster-General met on Saturday, and elected Sir Albert Spicer chairman. On Tuesday it began to sit for the purpose of taking evidence. It was announced that the Committee would hear any person who could bring before it any facts of which he might be possessed with reference to the charges or allegations of corruption on the part of any person or official in connection with the Marconi agreement.

At the first meeting of the Select Committee on Tuesday, Sir A. F. King, secretary to the Post Office, gave evidence, reviewing the history of the Imperial wireless scheme and the steps that had been taken towards carrying it into effect. It originated with the Marconi Co., which in March, 1910, applied to the Colonial Office for licences to establish a chain of stations throughout the Empire, without any financial assistance from the Government. The question was referred to the Cable Landing Rights Committee, which recommended that the scheme should be carried out by the State, and that negotiations should be opened with the Marconi Co. for that purpose. The Committee of Imperial Defence, on receipt of the above recommendation, in December, 1910, approved of that course, and treated the matter as urgent. At the Imperial Conference, held in June, 1911, a joint committee was appointed to carry into effect a resolution in favour of the establishment of wireless stations throughout the Empire, and the Post Office submitted proposals which included the payment of an annual royalty of £75,000 to the Marconi Co. for the use of its patents, a royalty of 5 per cent. on the gross receipts, and £50,000 for the erection of each station. The Cable Landing Rights Committee recommended the Postmaster-General to negotiate with the company on this basis, and an agreement was arrived at under which the company would construct the stations for £60,000 each, and take a royalty of 10 per cent. on the gross receipts for 28 years, with power to the Government to terminate the agreement after 18 years, or earlier if it ceased using the Marconi patents, together with other provisions. The tender was accepted on March 17th, 1912.

The Poulsen Wireless Telegraph Co. offered to erect long-distance stations at £34,000 each, but proof of the company's ability to effect continuous communication was not forthcoming. Tenders were not publicly invited, on the ground that no wireless company except Marconi's had acquired practical experience of long-distance working.

The witness was examined at length regarding the course of the negotiations. He stated that the Norwegian Government had made an agreement with the Marconi Co. at a higher price, and that estimates prepared by the Admiralty and Post Office engineers showed that the cost of the stations was reasonable. If the Poulsen Co. could have been relied upon to do the work, the Post Office would have accepted its tender, but the necessary experiments would have occupied a year or more, and the matter was urgent. The Poulsen interests had no company formed in this country, and no capital for experimental work. Had war arisen while the experiments were in progress, the position of the Post Office would have been indefensible. Sir A. F. King was still under examination when the Committee adjourned.

On Wednesday Sir A. F. King's examination was continued throughout the sitting, turning mainly on details in connection with the previous day's proceedings. The witness denied that the Marconi Co. acquired any monopoly under the agreement.

West Africa.—A wireless station at Fort Lamy, about 100 km. from Lake Chad, has just been completed, and has opened communication with the station at N'Guigmi, on the north-west side of the Lake, distant 210 km. The average range of these two posts is 300 km. Fort Lamy is the termination of the French telegraphic network in Equatorial Africa, which, by these new wireless posts, is placed in communication with French West Africa and with the European system, by means of the French cable from Brest to Dakar.—*Journal des Postes.*

Wireless in Wales.—The *Times* states that arrangements have been made by the Marconi Co. for the location of their Welsh trans-oceanic wireless station. The receiving station will be at Cefndu, near Carnarvon, while the transmitting station will be in the neighbouring county of Merioneth, close to Towyn.

Strike on a Cable Steamer.—According to the *Evening Standard*, 23 members of the crew of the cable steamer *Minia* struck work at Halifax, Nova Scotia; 14 were arrested and punished, but the other nine are still missing.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—November 5th. Balancer for the U.D.C. See "Official Notices" October 18th.

Atherton.—November 6th. One 250-KW. single-phase transformer, for the U.D.C. See "Official Notices" October 25th.

Australia. — SOUTH AUSTRALIA. — December 11th. Line material (Schedules 250-252), and submarine telegraph cable and cable tank, for the P.M.G.'s Department. See "Official Notices" to-day.

December 17th. Three sections of common-battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" October 25th.

November 8th and 12th.—(*a*) 340 A.C. and 800 D.C. electricity meters; and (*b*) insulated copper cables, for the Melbourne City Council. See "Official Notices" October 25th.

NEW SOUTH WALES.—December 11th. Telegraph cable, for the P.M.G.'s department. See "Official Notices" to-day.

Austria.—February 15th, 1913. The time for sending in tenders for an electric clock installation in Vienna has been extended to this date. Tenders to be forwarded to the Magistrate-Abteilung V., Vienna.

VIENNA.—November 11th. Supply to the K. K. Postökonomie-Verwaltung of 50,000 kg. of sal-ammoniac.

Barrow-in-Furness.—November 5th. Electrical and steam plant, &c., in connection with the electricity works extensions, for the Corporation. See "Official Notices" October 18th.

Birmingham.—November 13th. Uniform clothing and caps for the Corporation tramways. The Offices, Congreve Street.

Canada.— November 8th. The City of St. Boniface, Man., invites tenders for a variable speed motor and a motor-driven pump (1 to 1½ million gals. per 24 hours) against a pressure of 65 lb. (domestic) and 100 lb. (fire). 550 volts three-phase A.C. City Engineer's Office for plans. 5 per cent. deposit. Tenders to Mr. J. B. Cote, City Clerk.

Dublin.—November 4th. General stores for a year, for the Dublin United Tramways Co., Ltd. See "Official Notices" October 18th.

November 5th.—3,000-KW. steam turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" October 18th.

Dundee.—The T.C. invites tenders for the reinforced concrete piling and foundation work for the extension of the generating station at Carolina Port. Mr. H. Richardson, general manager and engineer.

Eastbourne.—The T.C. has decided to invite tenders for the supply of new flame arc lamps for public lighting.

Edinburgh.—The Edinburgh and District Tramways Co., Ltd., invite tenders for general stores (engine and boiler), electric light supplies, castings, &c. Mr. C. W. Shepherd, general manager South Charlotte Street.

Egypt.—November 11th. Tenders are invited by the Egyptian Ministry of the Interior for a Diesel oil engine with accessories, and a three-phase alternator with exciter, required for the extension of the electric light works at Zagazig. Sealed tenders for the complete installation, made on stamped paper of 30 millièmes, to the "Directeur de la Section des Municipalités et Commissions Locales, Ministère de l'Interieur," Cairo. Bank guarantee for 2 per cent. of the amount of the offer, with tender. The *cahier des charges* and plans may be seen at the "Section des Municipalités," as above, where copies may also be purchased on payment £E. 2 (£2 1s. 0½d.), which will not be returned.—*Board of Trade Journal.*

France.—PARIS.—November 9th. Tenders are required for the supply of battery material in two lots; also for telegraph office apparatus and accessories in five lots, and switchboards for telegraph lines. Tenders to be sent to the Sous-Secrétariat des Postes et Télégraphes, 103, Rue de Grenelle, Paris.

Greenock.—November 18th. One 3,000-KW. three-phase turbo-alternator, with condensing plant, &c., for the Corporation. See "Official Notices" to-day.

Hull.—November 20th. Electric lighting, fittings and bells, for the Teachers' Training College, Cottingham Road, for the Education Committee. Particulars (deposit £1 1s.) from the City Treasurer, Guildhall, Hull. Drawings to be seen at the Education Offices, Albion Street.

Italy.—LEGHORN.—November 12th. Tenders are invited for the supply of electrical coal-hoisting and unloading apparatus for the port of Leghorn.

Keighley.—November 11th. One 2,000-KW. steam turbo-alternator, for the Corporation. See "Official Notices" October 25th.

London.—L.C.C.— November 4th. Carbons, fittings, insulating materials and lamps, for a year. See "Official Notices" October 18th.

PORT OF LONDON AUTHORITY.—November 1st. Stores and materials, including carbons for electric arc lamps, carbon filament lamps, glass and glassware, india-rubber and gutta-percha goods, steam and other fittings, &c. Stores Superintendent, 106, Fenchurch Street, E.C.

L.C.C.—November 6th. Electric lighting installation at Mantua Street School, Battersea. See "Official Notices" October 25th.

L.C.C.—The Main Drainage Committee is about to invite tenders for new coal elevators and additional conveyor gear in connection with the extension of the boiler house at Crossness pumping station.

L.C.C.—November 13th. Electric lighting installation at the Ricardo Street School, Poplar. See "Official Notices" to-day.

Manchester.—November 9th. The Corporation Rivers Committee is inviting tenders for one 96-tube fuel economiser in sections of six tubes each, for Davyhume Sewage Works. Specifications, &c., from the Secretary, Rivers Committee, Town Hall.

Monkseaton.—November 13th. Construction of railways at Monkseaton, widening of a portion of the Avenue branch, and a new railway to Seaton Sluice, for the North-Eastern Railway. Plans, specification, and schedules of quantities obtainable from Mr. C. A. Harrison, chief engineer, Forth Banks, Newcastle-on-Tyne.

Morocco.— December 14th. Moroccan Adjudications Commission. 4,000 wooden telegraph posts. Tenders to M. le Président de la Commission Général des Adjudications et des Marchés, Dar-en-Niaba, Tangier. Copies of the form of tender and other particulars may be seen at the Commercial Intelligence Department of the Board of Trade, London, E.C.

Rawtenstall.—November 15th. Lancashire boiler, with superheater and mechanical stokers, for the Corporation Electricity Department. See "Official Notices" to-day.

New Zealand.—December 16th. Two 150-B.H.P. Diesel engines, two 100-KW. dynamos, balancer, motor-generator, switchboard, crane and oil tanks for Miramar (Town Clerk). Deposit £200. Board of Trade Commercial Intelligence Department, London, E.C.

December 30th.—The Napier B.C. is inviting tenders for two motor-driven centrifugal pumps, of British manufacture only. Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

South Africa.—November 18th. The Municipal Corporation of Cradock, Cape Province, is calling for tenders for two 50-KW. Diesel oil engines and dynamos complete, also supply mains and public lighting. Specifications from Mr. B. A. Paterson, town clerk, on deposit of £2 2s.

Spain.—November 21st. The municipal authorities of Lirio (province of Valencia) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Lirio (Valencia).

November 20th.—Tenders to the offices of the "Gobierno Civil de Jaén," for the establishment and working of a telephone system in La Carolina (Jaén). Although this contract will probably be awarded to a Spanish firm, nevertheless, the carrying out of the work may involve the purchase of some material outside Spain.—*Board of Trade Journal.*

Wakefield.—November 9th. Slack and smudge coal, for a year, for the Corporation electricity works. Electrical Engineer, Calder Vale.

York.—November 16th. Construction of about 1¼ miles of light railways, for the T.C. Mr. H. Craven, Town Clerk. Returnable deposit of £5.

CLOSED.

Barking.—The quotation of the British Westinghouse Co. has been accepted by the U.D.C., at £41, for an exciter and field resistance for a rotary converter; also the quotation of Messrs. Allen & Simmonds, at £184, for repairs to No. 5 engine at the generating station.

Bath.—Messrs. Lambert & Sons, Bath, after severe competition, have secured the contract for lighting the new hydro throughout by electric light, and also for part of the heating.

Burnley.—The tenders of Messrs. Siemens Bros. & Co., Ltd., London, for the supply of cable for the Colne Road section has been accepted.

Canada.—The British-Canadian Engineering and Supply Co. have been awarded contracts for supplying and erecting electric lighting plants in the following western towns:—Ruston-Proctor producer, gas engines and plant, together with all electrical equipment, both in and outside the power house; Gull Lake, Sask., 64 B.H.P.; Hanley, Sask., 50 B.H.P.; Outlook, Sask., 72 B.H.P.; Waldena, Sask., 50 B.H.P.; Rapid City, Man., 50 B.H.P. The suction gas plant, consisting of a gas engine and a gas producer, appears to be gaining considerable popularity in Western Canada. The Ruston-Proctor producer gas engine appear to be in favour.

Darlaston.—The Mechanical and Electrical Engineering Co., of Walsall and Birmingham, have secured the contract to equip the works of Messrs. J. and R. Rose, Ltd., of Darlaston, with motive power. They are putting in the Burnand patent wound rotor motors and regulators.

Eccles.—The tender of Mr. E. Beals—£202—for electric wiring and fittings, electric bells and telephones, has been accepted by the Corporation.

Halifax.—The Corporation has placed an order with the British Insulated and Helsby Cables, Ltd., for 3,400 yards '075 E.H.T. 6,600-volt three-core cable.

Italy.—The tender of the Società Italiana G. Bono e Cia., of Milan, has been accepted for the supply of 30,000 zinc electrodes for Callaud piles.

The Società Metallurgica Vittorio Cobianchi, of Omegna, have secured the contract for the supply of 30,000 kg. of 3·17 mm. gauge galvanised iron wire for telegraph purposes.—*Giornale dei Lavori Pubblici.*

London.—L.C.C.—The Highways Committee received the following tenders for telephone cables required for the maintenance of the Council's various tramway telephones:—

W. T. Henley's Co.	(Accepted)	£167
Western Electric Co.		185
Siemens Bros. & Co.		186
Johnson & Phillips		412

South Africa.—The Boksburg Municipality has decided to install a railless traction system, and, according to the *South African Mining Journal*, has accepted the following tenders:—

H. Ainsworth.—R.E.T. cars, £7,215.
Sykes.—Two motor-converters, £1,955.
H. Ainsworth.—Spares, £408 1s.
Dick, Kerr & Co.—Poles and fittings, £2,274.
Hubert Davies & Co.—Overhead line material, £1,203.
Hubert Davies & Co.—Cable and wire, £81.
Telegraph Manufacturing Co.—Tower wagon, £118.
Dick, Kerr & Co.—Tools, £218.

India.—Messrs. Siemens Bros. Dynamo Works, Ltd., has secured the contract for "Wotan" traction lamps to the Great Indian Peninsular Railway Co. for the ensuing 12 months.

Reading.—The T.C. on October 24th accepted the tender of the Tudor Accumulator Co., Ltd., for a battery, at £899; and that of the Lancashire Dynamo and Motor Co., Ltd., for an automatic reversible booster, at £324.

Salford.—The T.C. has accepted the tenders of Messrs. L. E. Wilson & Co. for an electric fan, &c., £21; of Messrs. E. M. Evans & Son, for electric light cables, £354; and of the Earl of Ellesmere, for 2,000 tons of No. 2 best washed slack, 11s. 10d. or 12s. per ton, according to mode of delivery.

Rathmines.—The U.D.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for 428 yd. '05 low-tension triple-concentric cable and disconnecting boxes.

Shanghai.—The Municipal Council has accepted the tender of the British Insulated and Helsby Cables, Ltd., for high and low-tension cables and trifurcating boxes.

Shrewsbury.—The T.C. has accepted the tender of Messrs. Adams & Co., of Shrewsbury, for electrical supplies.

Wolverhampton.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., at £270, for an additional panel for the main switchboard at the generating station.

Worksop.—The U.D.C. has accepted the offer of the British Insulated and Helsby Cables, Ltd., for 25 electrolytic prepayment meters.

FORTHCOMING EVENTS

Institution of Electrical Engineers (Manchester Local Section).—Friday, November 1st. At 7.30 p.m. At the Midland Hotel, Manchester. First meeting of the session. Address by Mr. A. A. Day, to be delivered by Prof. E. W. Marchant, vice-chairman.

Tuesday, November 5th.—At 7.30 p.m. At the University, Manchester. Paper on "The Turbo-Generator: A High-Speed D.C. Generating Unit," by Mr. W. Creedy.

Royal Institution.—Monday, November 4th. At 5 p.m. General meeting.

Society of Engineers.—Monday, November 4th. At 7.30 p.m. At the I.E.E., Embankment, W.C. Paper on "The Generation and Electrical Transmission of Power for Marine Transportation," by Mr. W. P. Durtnall.

Institution of Civil Engineers.—Tuesday, November 5th. At 8 p.m. At the Institution of Mechanical Engineers, Westminster, S.W. Presidential address by Mr. R. Elliott-Cooper, and presentation of medals.

Institution of Electrical Engineers (Glasgow Students' Section).—Tuesday, November 5th. At 8 p.m. At the Royal Technical College, Glasgow. Address by Mr. W. W. Lackie, chairman.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, November 6th. At 7.30 p.m. At the Hotel Metropole, Leeds. Inaugural address by Mr. S. D. Schofield, chairman. Smoking concert.

Physical Society.—Friday, November 8th. At 8 p.m. At the Imperial College of Science, South Kensington. Papers on "A Method of Measuring the Thomson Effect," by Mr. H. R. Nettleton; "An Improved Joule Radiometer and its Applications," by Mr. F. W. Jordan; and "The Thermomagnetic Study of Steel," by Dr. S. W. J. Smith.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, November 4th.—"A" Company. Company training, 7 to 10 p.m.

Tuesday, November 5th.—"B" Company. Recruit instruction, 7 to 10 p.m.; company training, 7 to 10 p.m.

Thursday, November 7th.—"C" Company. Company training, 7 to 10 p.m.

Friday, November 8th.—"D" Company. Recruit instruction, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, November 9th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

NOTES.

Registration of Contractors at Liverpool.—The decision of the Liverpool City Council requiring firms whose names appear on the Corporation list of contractors, and who wish to have them retained in future, to pay a registration fee of 5s., has occasioned much indignation in many trading circles. The British Electrical and Allied Manufacturers' Association has presented its protest against the resolution, and has written to the Council pointing out that the registration fee is regarded as objectionable, as adding an additional tax to the expenses, already heavy, incurred in municipal trading. The letter adds that members are proposing, subject to the direction of the Council of the Association, to refrain from complying with it, and asks whether the Corporation can see its way to rescind the resolution or hold it in abeyance.

Royal Mint.—The forty-second annual report of the Deputy Master, the Rt. Hon. William Ellison Macartney, shows that, during 1911, over 146 million pieces were struck. The issue of gold coin exceeded 33 million pounds sterling, this being more than 2½ times the average of the past 10 years, and 8 millions in excess of any previous issue. The net profit on the year's working amounted to £374,266. In the memorandum by Mr. Rigg, superintendent of the operative department, details are given of the cost of the coal-gas fuel recently adopted for bullion melting in the new melting houses (see Electrical Review, November 3rd, 1911). The figures show that, from April to December, 1911, the cost per cwt. of bullion (gold, silver and bronze) melted, was 13'8d., and the corresponding figure from January to March, 1912, was 11'1d. This reduced consumption has been brought about by various minor modifications, and there is good reason to anticipate further economy in the future. As no nickel-bronze alloy, involving as it does an increased consumption of fuel, was melted during the period referred to, the above figures cannot be regarded as an average year's work. For gold only during the year, the cost per cwt. melted was 5'2d. The new gold melting house has 10 furnaces, the necessary burners being supplied with gas from a 4-in. main and with air from a 5-in. copper pipe. The blower for the air blast is a No. 6 Reichelm, driven by a 14-H.P. Siemens motor. The silver house contains 16 furnaces; 6,000-oz. crucibles are in use, but the furnaces are adapted for an 8,000-oz. size, and these are to be substituted at an early date. In the gold house an ordinary day's melting is 3 tons of standard bullion, and in the silver house as much as 9'6 tons of silver can be dealt with.

Heavy demands were made during 1911 on the newly-formed stamp plate and die department, in connection with the preparation of plates and dies for postage and National Health and Unemployment Insurance stamps. Since the commencement of this work 125 adhesive stamp electros and 2,566 electros for postcards, and other stamp and instruction plates, have been prepared, as well as 62 electros for National Health and Unemployment Insurance requirements.

During the year the old "Grasshopper" atmospheric engine, employed to drive the automatic weighing machines, was replaced by a Siemens motor. Two other motors have also been installed, thus bringing the total number in use to 89, with a gross horse-power of 786. Arc lamps of various types number 78, as against 77 in 1910. Incandescent lamps have increased from 951 to 1,008, and three new electric radiators raise the number in use to 10. The average monthly output of the generators during 1911 was 29,163 units, as compared with 26,193 in 1910.

The report of the Deputy-Master of the Ottawa branch Mint states that electrolytic refining was commenced there in Jan., 1911, and that by the end of the year 10 silver and 12 gold cells were ready for work, the former for the first parting of the silver and the base metals from the gold, and the latter for the further refining of the gold thus treated. Owing to a difference in voltage of the two sets of cells, it was not found economical to use the same dynamo, as the introduction of resistance to balance the circuits would have caused complications. A smaller generator, giving 225 amps. at 15 volts, was therefore installed for the gold cells, and the original dynamo used for the silver cells only. A still smaller machine is used for the gold-dissolving cells for the production of gold chloride. By this means each set of cells can be worked at its maximum capacity. This plan has been adopted in the latest of the United States refineries. A successful innovation has been the heating of the gold cells by electric heaters in place of steam coils. The heaters are worked with a time switch, which automatically opens and closes the circuit every 12 hours, so that the current is not being used when the cells are idle.

Tramcar Accidents in Glasgow.—Answering a Parliamentary question by Mr. Watt, Mr. Robertson stated that 13 fatal accidents had been reported to the Board of Trade as having occurred on the Glasgow Corporation tramways during the present year, eight of which were due to persons being knocked down by a car. None of these accidents occurred on steep gradients, and in no case did the speed appear from the reports made by the Corporation to have exceeded 12 miles an hour. A speed of 16 miles is permitted on certain portions of the Corporation tramways, but on steep gradients lower limits of speed have been imposed.

In the Parliamentary questions Sir W. Menzies asked the President of the B. of T. whether, having regard to accidents on the tramway system of Glasgow, he would state, for the purposes of comparison, the number of miles travelled, the number of passengers carried, and the number of accidents on all the electric tramways in London, and the same figures for the Glasgow tramways. Mr. Buxton replied that during 1911 36 persons were reported to the Board of Trade to have been killed, and 927 to have been injured on the various tramway systems within the Metropolitan police district. The corresponding numbers in respect to the Glasgow tramways were 8 persons killed and 203 injured. Approximately 800 million passengers were carried during the year in Greater London in cars running 80 million miles, whilst in Glasgow about 275 million passengers were carried and 22 million car-miles run.

An Engineering Exhibition.—It is stated that an exhibition of the Engineering and Allied Trades will be held in Bristol during February next.

Electrical Trades Benevolent Institution.—The date of the annual festival dinner has been definitely fixed for Wednesday, April 16th.

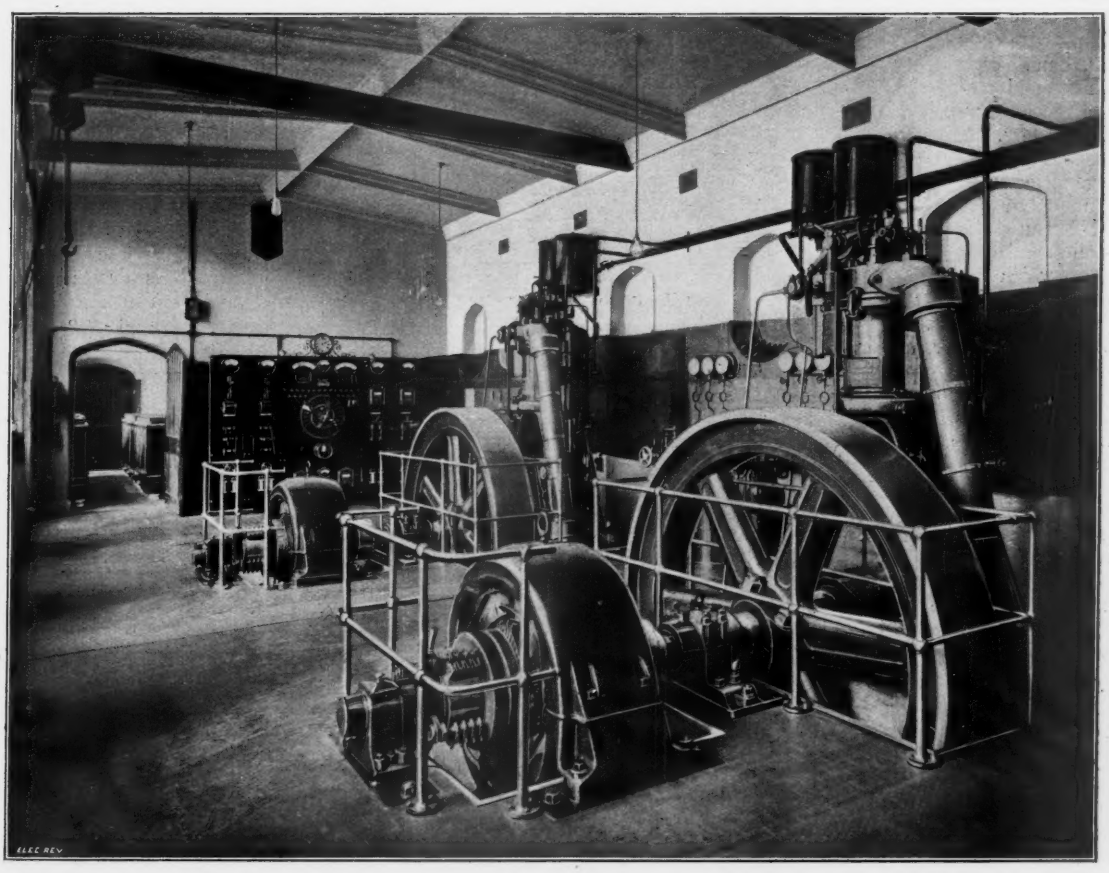
(*Continued on page* 710.)

ELECTRICITY AT STONELEIGH ABBEY.

We were recently enabled by the courtesy of the Right Hon. Lord Leigh to pay a visit to the installation of electric light and power which has been carried out at Stoneleigh Abbey, Kenilworth, the family seat of Lord Leigh, by the Midland Electric Light and Power Co., of Leamington Spa. This installation presents many features of more than ordinary interest; in addition to a very extensive lighting scheme, it provides for the electrical driving of the farm and estate machinery, and a novel and effective system of fire protection, and it has been carried out with a single eye to the attainment of the most satisfactory results, regardless of the cost. Safety and durability have been amongst the most prominent considerations, and the amenities of the historic mansion, a large part of which was erected in the tenth century, have been most carefully preserved.

Stoneleigh Abbey.

The system employed is two-wire direct current at 100 volts, a pressure which has proved, with metallic-filament lamps, quite adequate to meet all requirements. The generating plant has been housed in a building which formerly formed part of the stables, and, as will be evident from the accompanying illustration, is both lofty and well lighted, besides providing ample floor space. The plant consists of two Diesel engines coupled to shunt-wound dynamos; the engines, which were built by Messrs. Sulzer Frères, are rated at 50 b.h.p. each, running at 230 r.p.m., and drive four-pole dynamos supplied by the Electric Construction Co., Ltd., of the interpole type, giving 260 amperes at 100 to 150 volts. Over each engine a girder run-way is provided to carry lifting tackle. Fuel oil is stored in a 10-ton underground tank outside the building, from which it is raised by a hand-pump to an elevated drum, whence it gravitates to a pair of filters near each engine. A pair of storage cylinders containing compressed air for starting purposes is provided, with the blast receiver, for each engine, and the two sets are coupled by pipes so that they can be used in connection with either engine. The local water supply is hard, and to avoid deposit in the jackets the cooling water is circulated through a Little cooler provided with a motor-driven fan, so that the same water is used continuously; this is a novel and useful feature of the plant. In view of recent events, it is interesting to note that provision is made for blowing off any lubricating oil which may—and does—find its way into the blast receivers, by means of a connection to the bottom of the latter. The exhaust from each engine is taken into a drum silencer, from which it passes through a short pipe into a second drum, by way of extra precaution against noise, before it escapes to atmosphere; and an expanding cone device at the top of the exhaust pipe further guards effectively against

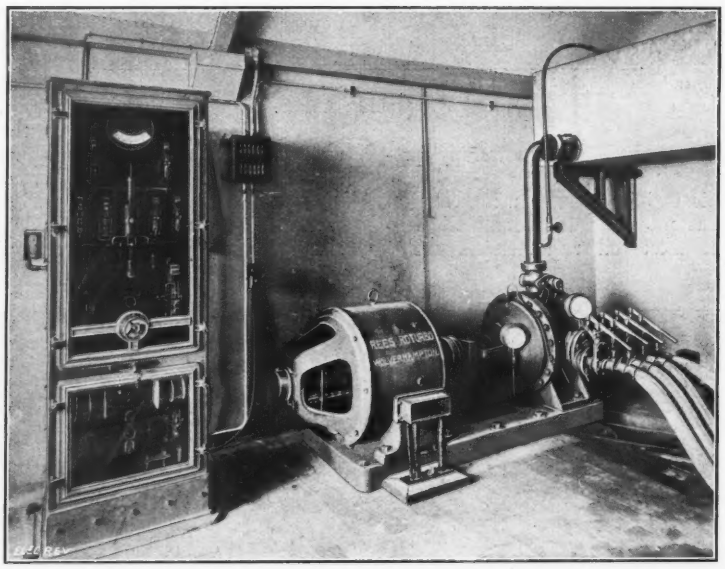


Interior of Engine Room at Stoneleigh Abbey.

Saloon in Stoneleigh Abbey.

nuisance from this cause, the exhaust being inaudible at a short distance.

The main switchboard is situated at the end of the engine room, and provides for two main feeders, besides the two generators and the storage battery. A Chamberlain & Hookham meter is connected in circuit with each feeder, and two, for charge and discharge respectively, with the battery. An Everett-Edgcumbe leakage detector is mounted on the board beneath the end-cell regulating switch, which is operated on the discharge side with a Trumpy automatic regulator. The latter has been found quite satisfactory.



Rees Roturbo Electric Fire Pump.

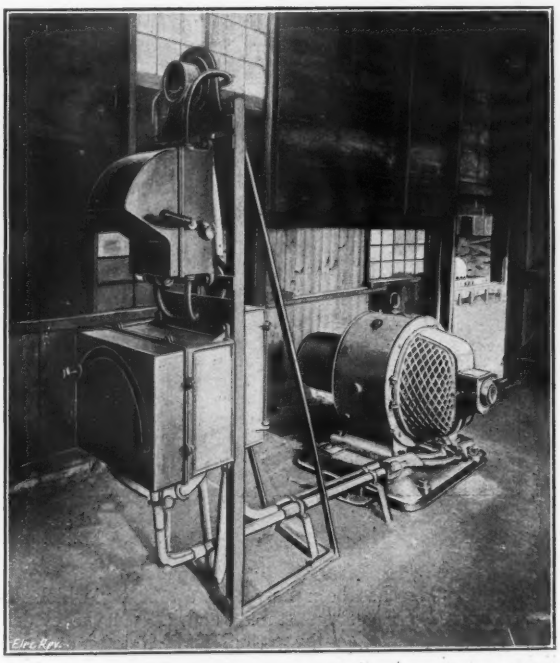
The connections from the switchboard to the battery in the adjoining room are of solid bare copper rod, bent cold, and carried through the wall in ebonite tubes; in the battery room they are carried on porcelain bobbins.

The battery consists of 56 Tudor cells, each of 2,000 ampere-hour capacity at the 10-hour rate, and is believed to be the largest installed in any private house in this country. It is capable of giving a discharge of 800 or 900 amperes for short periods without injury, and can supply power to a 40-H.P. motor in the sawmill, or to the fire pump, for several hours. The room in which it is housed—another part of the old stables—is large and airy, and is well ventilated with the aid of Sturtevant electric fans.

From the main switchboard a pair of two-wire feeders of 0·4 sq. in. section, insulated with vulcanised bitumen, are laid on the solid system, in earthenware troughing, to the Abbey and the farm buildings respectively. In the Abbey the feeder is looped into a main switchboard in the old part of the building, and is carried on to a similar board in the newer portion. Each of these boards is provided with main double-pole switches and fuses, and is combined with a distributing switchboard controlling the distributing fuseboards on the various floors. The wiring is everywhere enclosed in screwed solid-drawn steel tubing, supplied by the Credenda Conduits Co., of Aston. The greatest possible care had to be exercised to carry out the wiring without injury to the existing decorations, the wainscoting and panelling being in many cases of great age and beauty, and it will readily be understood that heavy expense was incurred in dealing with this difficult and delicate part of the work; but it was very successfully accomplished, the conduit being everywhere concealed (except in the basement) without showing a trace of its erection. The existing fittings also had to be utilised as far as possible; these were mainly candelabra and colza lamps, and in the former electric candles were employed, as illustrated in the adjoining view of a saloon, while the latter, having opal globes, were easily converted, though the wiring of the fittings presented some awkward problems. Under the circumstances, it was impossible to introduce modern methods of illumination such as indirect lighting, and we cannot but think that personal comfort and freedom from glare have been sacrificed to an affectionate regard for the antique.

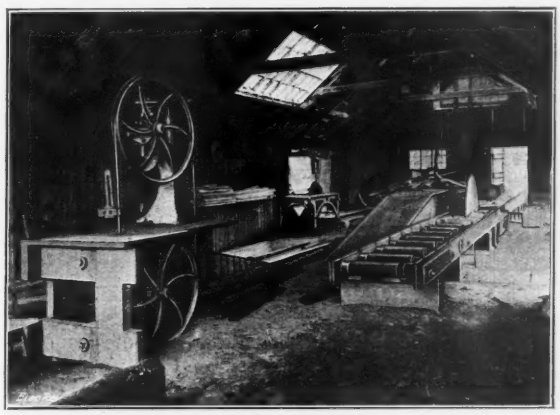
No attempt has yet been made to carry out even a portion of the cooking electrically, though a considerable number of electric heaters, both radiators and convectors, are employed. In other respects, however, full advantage has been taken of the capabilities of the supply; for example, electric fans and hot plate cupboards are freely used in the huge kitchen and elsewhere, knife cleaners and plate polishers are driven by motors, and an automatic electric organ-blower has been fitted to the organ in the old Chapel which forms part of the Abbey. The installation comprises some 1,500 Osram lamps in all, though the exact number cannot easily be determined. The original vaulted crypt is lighted with electric lamps fixed in the ancient lanterns on the walls.

In the farm buildings—which are all lighted with electric lamps in strong glass fittings—a chaff-cutter and corn-crusher is driven through a countershaft by a 6-H.P. motor,



Motor driving the Sawmill.

and in the sawmill two circular saws and a band saw are electrically driven. In the latter case the motor, of 42 H.P., is mounted in a shed, together with the starting and regulating gear, as illustrated on page 706, and drives an underground shaft, which passes under the mill and drives the saws by belt. One of the saws is 5 ft. in diameter. The motors are of Messrs. Veritys' make, shunt-wound and

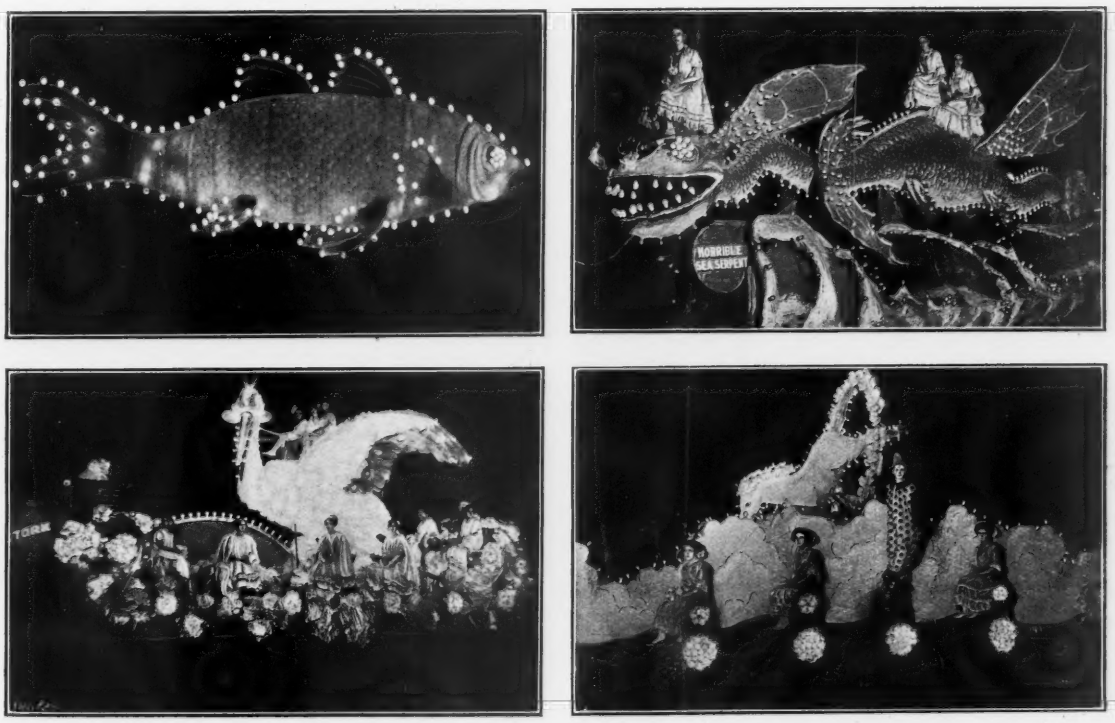


Electrically-driven Sawmill at Stoneleigh Abbey.

provided with interpoles. Many of the workmen's cottages are electrically lighted.

The electrical fire-pump installation is of exceptional interest. Formerly a large modern steam fire engine, hauled by horses, was depended upon, but the time taken to get this into operation—at least 10 minutes under the most favourable conditions—was a great drawback, as the most important period in the case of an outbreak of fire is the first minute or so, during which it can often be got under control. A very complete electrical pumping plant and system of hydrants has, therefore, been installed, which ensures the provision of an instant and abundant supply of water.

A ring main has been laid underground entirely round the Abbey, as well as a rising main which feeds hydrants on each floor, and on the roof of the building. Outdoor electric lamps are provided near the hydrants on the roof. The pumping plant is fixed in a pump house close to the Abbey, and about 100 yards from the River Avon, which flows past the Abbey at a level of 15 to 20 ft. below the floor of the pump room. The pump was made by the Rees Roturbo Manufacturing Co., Ltd., of Wolverhampton, the sub-contractors for the complete installation, and is driven by a motor rated at 35 B.H.P. for normal duty and up to 55 H.P. for emergency duty; the pump is continuously and automatically primed from the domestic water supply, and arrangements are made so that any leakage of the footvalve is at once indicated, so that the pump cannot fail to act directly it is called upon. An abundant supply of water is obtained from the river, which feeds a sump through a grating. The maximum output of the plant is about 400 gallons per minute at a pressure of 117 lb. per sq. in. We give on page 706 a view of the pump, showing the motor and switchgear, and four hoses connected with the fire mains above mentioned; in case of need, these hoses could be used to couple the mains to the steam engine, but that is a very remote contingency. The motor is controlled by automatic switchgear supplied by Messrs. Brook, Hirst & Co., which can be set in operation by push-buttons installed at the various hydrants; the speed with which the plant gets to work is extraordinary, the full pressure being available in less than half a minute. A great advantage of the Rees-Roturbo pump in this connection is its automatic regulation; no matter how many jets are brought into service, the motor can never be loaded above its normal rating, and the drop in pressure when a large number of jets are in operation is small, although the volume of water thrown per second is greatly increased. On the other hand, if all the jets are shut off no harm is done, as the pressure never rises above a fixed value; hence it is possible to leave the pump always connected with the main which supplies the Abbey, as there is no risk of a burst pipe and consequent damage to the contents of the Abbey. The pump gives a most efficient and unbreaking jet, to an unusual height. The switchgear does its work admirably; it runs the motor up to the full normal speed, and on emergency, resistance can be inserted in the motor field by hand, so as to increase the speed and output. The system, as a whole, is well



An Electrical Fairyland: Illuminated Devices at Los Angeles. (See p. 708.)

worthy of the attention of owners of large buildings where an immediate supply of water in case of fire is a necessity, as it provides this with certainty and simplicity.

The fire pump is ordinarily used for watering the garden and similar service, which affords an additional guarantee that it shall be found in good order when an emergency arises. It will be noticed that the attendance of the fire brigade—composed of employés—is not necessary to bring the fire plant into use; any person at a hydrant can, unaided, start the pump instantly and bring a jet to play on the fire.

Stoving Ovens for Enamelling Conduit at the Simplex Works (see next page).

Hence it is called the "one-man fire engine" by the members of the brigade.

The difficulty of drying hose which has been used has been neatly solved by placing a few electric heaters in a box lined with asbestos, and provided with connectors for the nozzles. The hoses are hung up from the rafters of the riding school over this box, with their lower ends fitting over the connectors, and the natural up-draught of heated air through them soon dries up the moisture, with a current of 20 amperes at 100 volts.

Element Winding Room at the Simplex Works.

A complete system of telephones connected with an exchange with 20 ways has been installed in the Abbey and the houses of various members of the staff of the estate; a special jack-board has also been provided for the use of Lord Leigh, which enables him to isolate any person from the system and to speak with him alone, without going through the exchange, and therefore without the possibility of interruption or overhearing.

Provision is made in the coach-house, now a roomy garage, for charging an electric brougham, and doubtless in course of time many other uses will be found for the versatile agency which is now at the disposal of the residents. As regards the economic aspects of the matter, it is interesting to note that whereas, when oil was used for lighting and coal for driving the sawmill, &c., the former cost £300 a year and the latter £200, the total cost of fuel oil for the Diesel engines, which has replaced both these items, for a year was only £25. The capital charges on the plant would go far towards balancing these figures, but the facts are certainly remarkable, and, of course, the convenience, safety, saving in labour, and other advantages of electric light and power are all to the good.

In conclusion, we must express our thanks to Mr. Percy Olver, the manager of the Midland Electric Light & Power Co., who has been responsible to Lord Leigh for the whole of the installation, and also to Mr. Fish, the estate engineer, for affording us the opportunity of visiting this very excellent example of country-house equipment, and for providing the photographs and particulars embodied in this article.

AN ELECTRICAL FAIRYLAND.

More beautiful and dazzling than the dreams of the "Arabian Nights," or the wonders of Grimm's fairy tales, are the electrical pageants that take place every two or three years in Los Angeles, California—a city of fiestas and carnival displays. These electrical wonderlands are usually given in connection with the gatherings of some great organisation, such as the Order of Elks or Shriners, when delegates and visitors flock from all parts of the world to this pleasure-loving city to elect their officers and (mainly) to have a good time. On these occasions great parades are the order of the day (and night), and it is in connection with the night pageants that the marvellous electrical floats are sent through the streets. The expert electricians and the artists work together on such occasions to produce masterpieces of imagination, painted in coloured light. Each float costs about a thousand dollars, and contains myriads of incandescent bulbs of all colours, which are used to outline the fantastic designs. Many of these are chosen from the characters of Mother Goose or fairy tales, and others depict weird and wonderful creatures such as the octopus, the sea serpent or the dragon, while such creations as gigantic gold-fish, dragon flies, storks and all manner of animals, insects and birds are reproduced in gigantic size and blinding coloured lights. Some of these devices are reproduced on p. 707.

Assembling Shop for Heating and Cooking Apparatus.

No horses are used to draw these electric floats, as they are built upon flat cars and derive power to propel them from overhead wires, with which they make contact by trolleys. No drivers are in sight, as they are concealed by the decorations, and the pageant moves through the streets with no visible means of propulsion. The lighting is also derived from the overhead wires, and in some of the floats electrical mechanism is used to give motion to the weird creatures. For instance, the gold-fish waves his fins and moves his head from side to side as if he were swimming, while the stork extends his long neck and peers in every direction. The sea-serpent wriggles and rolls his eyes, and

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the trick horse regularly jumps through a hoop every couple of minutes like a circus nag. In some instances fountains of real water are kept playing by a little electric motor, and in others a "flasher" causes waves of light to traverse the design of the float, giving a brilliant and living effect.

To add still more to the beauty of the pageant, places are arranged on most of the floats for young girls, clad in classic drapery, who toss flowers to the by-standers along the streets.

No royal procession in other centuries could equal the vivid display of colour and light which our own age has been able to produce from the mysterious fluid, electricity, which produces effects as wonderful in their beauty as are its manifestations of power in their majesty.

THE SIMPLEX CONDUIT WORKS.

Some years ago (November 9th, 1906), we described and illustrated the Simplex Co.'s works at Garrison Lane, Birmingham; since then additions have been made which include departments devoted exclusively to the manufacture of fuse wire and enclosed fuses, decorative metal work, electric light fittings, and electric heating and cooking.

On the opposite page we give some views taken in the factory, which gives permanent employment to upwards of 300 hands, and is one of the most complete of any devoted solely to the manufacture of the smaller kinds of electric lighting and power supplies and current-consuming devices.

The conduit and fittings department is specially laid out for the manufacture in quantities of fittings and accessories for conduit wiring, which now number many hundreds of different types.

The switchgear and fuse department is devoted to the manufacture of main switchboards, sub-distribution boards and kindred apparatus. All types of sub-distribution boards are assembled in the shop, as well as motor-control panels, switchboard panels and main boards for private plants.

As an auxiliary to the manufacture of distribution boards, the company some years ago laid down very complete machinery for the production in large quantities of fuse wire and enclosed fuses, and they are now among the foremost manufacturers of this class of material. All grades of enclosed fuses are made, from 3 amperes low voltage up to 300 amperes at 2,000 volts. The company are also sole makers of Hope's "Bi-Metal" fuse wire. A large hydraulic press has been installed for the manufacture of fuse wire and strip.

The company have largely developed the manufacture of cast-iron watertight fittings for use in factories and for outdoor lighting. For this purpose, as well as for the manufacture of conduit fittings, a very extensive foundry for casting in common iron, malleable iron, brass and aluminium has been established.

Arising out of that section of the works set apart for the production of the conduit system is a department devoted to the assembling of the china accessories for use therewith; these include the many types of "porcelain interiors" which have been designed for use with conduit boxes, jointing pieces, and similar labour-saving devices.

The company have a large department devoted to the manufacture of heating and cooking material. In addition to the standard material which is manufactured, this department is in a particularly favourable position to undertake special work, such as electrically-heated appliances for restaurants and for industrial purposes, at the shortest notice. In the element winding section alone nearly 20 hands are employed. In connection with this department is a very completely equipped test-room, in which all appliances are thoroughly examined before leaving the factory.

A year or two ago the company purchased the business of Messrs. Jesson, Birkett & Co., the well-known Birmingham firm of art metal workers, and upon this incorporation have built up their electric fittings department, which is directly under the control of Mr. T. Birkett, late managing director of Jesson, Birkett & Co. An extensive plant for plating in copper, nickel, silver, pure tin, and for bronzing has been installed, and another department is devoted to the manufacture of fans and small motors.

The company have now established offices, branches and agencies throughout the country to the number of 12, at which stocks of Simplex material are maintained. In a large number of instances representative showrooms are also included, and each branch is under the charge of a competent engineer.

ELECTRIC COOKING IN A SCHOOL.

The accompanying illustration shows the "Tricity" cooking installation in the kitchen of St. Cyprian's School, Eastbourne, which has been carried out by the local "Tricity" agents, Messrs. R. H. & J. Pearsons, and comprises four standard ovens, 19 in. × 16 in. × 14 in., four 2-gallon urns, and two duplex and two single cookers for boiling and grilling. The apparatus is divided into three batteries, respectively for roasting, hot water, and grilling and boiling; each battery is independently controlled by a main switch and fuse, a system permitting easy extension in any direction.

An Electric Kitchen.

The school is situated on the outskirts of the town at the foot of the Downs, so that Mr. Brydges, the Eastbourne engineer, deemed it advisable to give a supply by installing a 12·5-kw. Berry transformer connected to the high-pressure mains; this has been placed in a brick chamber immediately outside the kitchen.

The maximum demand of the installation is 15 kw., and a minimum consumption of 10,000 units per annum is guaranteed. During term time the household numbers 100.

Concreting Wooden Poles.—The Indianapolis Light and Heat Co. now makes a practice of concreting all its poles at the ground line to prevent rotting and deterioration, some 1,500 poles having been so treated during the last season. New poles are erected and first allowed to stand a year to make sure that they have become firmly set. With a small spade an opening 4 in. to 5 in. wide is then made all round the pole to a depth of 3 ft. or 4 ft., and this is poured full of concrete, tamped securely and troweled off with an inclined water-shed to prevent water from standing about the base. The concrete collar extends a few inches above the ground, and gives a neat appearance to the pole base. A concreting gang of four men with a team can concrete eight to ten poles in this manner in a day. Estimating the cost of keeping such an outfit in the field to be about $15 a day, Mr. T. A. Wynne, general superintendent of the Indianapolis company, figures the cost of concreting poles at $1.50 each. Experiments with enclosing the poles in a covering of concrete before erection have also been carried out at the company's pole yard. These earlier experiments have all been discarded, however, in favour of the new plan of concreting at the ground line, the portion to which the major part of the deterioration is confined. Old poles as well as new are receiving this treatment, which is expected to extend their lives by an amount far exceeding the outlay for the concreting work.—*Electrical World.*

NOTES.

(*Continued from page 704.*)

Fatalities.—On 23rd ult., at Southwark, an inquest was held concerning the death of Thomas Woodland Crane (33), an electrical fitter in the service of the L.B. and S.C. Railway Co., who died in Guy's Hospital on the previous Sunday from the effects of burns sustained earlier in the day in the course of his employment in the company's electric sheds at Norwood Junction.

Mr. C. H. Brewer, solicitor, and Mr. R. H. Houghton, superintendent of the electric department, represented the railway company.

Herbert Sansom, foreman of the electric sheds, stated that before going to supper on Saturday, October 19th, the deceased had done some work in No. 4 road, the current from which witness had cut off. Witness gave Crane the key of the switch. The same key controlled the current for Nos. 5 and 6 roads as well. At a quarter to one a.m. witness was in his office when he saw the light go out, and he at once knew that something had happened. Just then deceased's mate came and said, "Mr. Sansom, Crane is on No. 7 road, and the current is off." Witness replied that 7 and 8 were alive, and that Crane had the key for 4, 5 and 6. Rushing into the switch cabin, witness put No. 7 road to earth, and went up to the station and told them to keep the current off. On going to No. 7 witness found the deceased on the roof of a train with his feet hanging over the guard rail. He was in flames, and witness eventually smothered these by the aid of some coats, motorman Cruse having meanwhile come to his assistance. The deceased was then removed to the store room, where his injuries were treated, and he was afterwards conveyed by train to Guy's Hospital, where he died the same day. When asked what he was doing on No. 7 road instead of No. 4, the deceased replied, "What road was I on?" When witness told him he was on No. 7, he answered, "No. 7; well, I have got the key for Nos. 4, 5 and 6." Although he was in dreadful agony, he added, "No one was to blame, only myself." Witness subsequently examined the train, and found that the bows were up instead of down, and that the high-tension door was shut instead of being open. The deceased should have lowered the bows before commencing work or getting on top of the train. Mr. Brewer explained that there was not a printed rule to this effect, but it would be put in the revised rules which were now in the press. The deceased well knew that the bows should have been down. The voltage was about 6,500 volts. Witness added that he had himself told the deceased that the bows should be down while work was being done. He could not account for the deceased being on the wrong road. He was a careful man, and had never met with an accident before. It was the duty of the deceased to come to him for the key of the switch controlling the section on which he was going to work. If he had asked for the key of No. 7, the accident would not have happened. The bows being up would not have made any difference if the road had been dead. Witness heard that the rear part of the train was alight after the accident. The deceased was about to put a new strip of aluminium on the bows, and he could not have done that while they were resting against the overhead wire. The deceased had done Nos. 4, 5 and 6 roads. Mr. Brewer intimated that the accident had been reported to the Board of Trade. Continuing, Mr. Sansom said he was responsible for cutting off the current. Men never allowed him to see them working with the bows up.

Bertram Mackrell, the deceased's assistant, who was mounting a ladder at the time, said deceased touched the live wire, which short-circuited, and set fire to his clothes. Witness admitted that the deceased did not always lower the bows, and on one occasion he had remonstrated with Crane for taking unnecessary risks at the Crystal Palace. Witness also admitted that he had been supplied with the company's book of rules, but had never looked at them. They sometimes disregarded the rule which required the high-tension doors to be closed. Deceased, he added, was a skilled mechanic.

Dr. Arthur James McNair, of Guy's Hospital, described the deceased man's terrible injuries, and said he died from shock following the electric current and the burning. Witness did not know how many volts it took to kill, but they had a patient alive in the hospital who had had 6,000 volts. The deceased told Witness that a short circuit occurred at Tulse Hill, and all the lights went out; that he got on the train by mistake, and the current was turned on.

Mr. Brewer said the effect of the deceased touching the live wire was to make a short circuit and stop all the electric trains. The lighting of their sidings was done by the Croydon Corporation, independently of the company's own supply.

After hearing further evidence, the jury returned a verdict of "Accidental death," adding that they were unable to agree as to whose fault it was—whether the company's or the deceased's. Mr. Brewer expressed the company's regret at the accident, and their sympathy with the widow and family.

Post Office Engineers.—In the Parliamentary Papers Mr. Snowden asked the Postmaster-General whether it was to be understood that 44 was the total number of second-class engineers who, as the result of his reconsideration, were to be advanced to the class of assistant engineers. Mr. H. Samuel replied that as the result of a very full and searching inquiry into the claims of the second-class engineers to be advanced to the class of assistant engineers, he had been glad to find himself in a position to confer immediate advancement upon 44 officers. He hoped to be able to grant similar advancement to a limited number of other members of the second class as opportunities arose.

The Johannesburg Gas Engines.—It will be remembered that one of the conditions of the compromise between the Johannesburg Municipality and Messrs. Beardmore & Co., was that the firm should be granted a three months' option of purchasing the gas plant for the sum of £5,000. The option expired in July last, and, in consequence, the whole plant became the property of the Council. The Tramway and Lighting Committee then decided to ask Prof. Dobson to report as to the value of the plant. After a preliminary investigation, Prof. Dobson asked the Committee to vote a sum of 200 guineas for a thorough investigation. The Committee approved of his suggestion, the sum was voted by the Council, and endeavours are now being made to turn the engines to account.—*South African Mining Journal.*

A 15,000-kw. Unit for Manchester.—We are interested to learn that the Manchester Electricity Committee last week accepted the tender of Messrs. James Howden & Co., Ltd., of Glasgow, for the above plant, with Messrs. Siemens as sub-contractors for the alternator, and Messrs. Richardsons, Westgarth, for the condensing plant. The main turbine will be of the Howden-Zoelly pure impulse type, with 14 wheels, designed to work with a steam pressure of 200 lb., superheat 200° F., a vacuum of 27½ in., and to run at a speed of 1,000 R.P.M. The shaft diameters at the journals will be 16 in. The main alternator will be of the totally enclosed type, and will embody all the recent improvements in design introduced by Messrs. Siemens. The ventilating air is to be supplied by fans on the rotor as well as by an external blower. All air will be filtered by the standard method adopted at Manchester on all the large turbo-alternators, the air being taken in and exhausted from the top half of the stator frame. The rotor of the machine will be of the solid type, cylindrically wound. The main condenser will be of the "Contraflo" design, and will be worked in conjunction with circulating pumps of the Rateau type, in duplicate, both sets being steam turbine driven. The kinetic air-pumps and water pumps are also to be in duplicate, and each line is to be driven by an auxiliary steam turbine. The weight of the turbine and alternator will be 250 tons, which, with the inclusion of the condensing plant, will bring the total up to approximately 350 tons.

Metropolitan Association of Electric Tramway Managers.—A meeting of the members of this Association was held at the Municipal and County Club, Whitehall, S.W., on Thursday, October 24th, when there were present Messrs. A. H. Stanley (London United), chairman; H. E. Blain (West Ham), W. C. Ullmann (East Ham), F. Schofield (Leyton), L. E. Harvey (Ilford), C. Mittlehausen (Bexley), A. Coveney (Erith), W. Hammond (Metropolitan Electric), S. Dudman (Dartford), E. J. Vaughan, (Luton), and T. B. Goodyer (Croydon), hon. secretary. The following were unable to be present: Messrs. W. Holmes (Barking), W. Murray (Walthamstow), R. Birkett (Southend-on-Sea), R. C. Bullough (Colchester), T. Medcalf (Swindon), P. N. Gray (Gravesend), J. A. Forde (Isle of Thanet), A. T. Lambert (Maidstone), A. V. Mason (South Metropolitan), T. B. Holliday (Hastings), and Z. E. Knapp (London United). Mr. H. E. Blain was elected chairman, Mr. W. C. Ullmann, vice-chairman, and Mr. T. B. Goodyer was re-elected hon. secretary.

The Electrical Engineers' Ball, 1913.—The tenth annual Electrical Engineers' Ball is to take place on Friday, January 31st, at the Hotel Cecil.

Electric Sleep.—Following on the experiments of Dr. Leduc with direct current, Dr. F. Nagelschmidt, of the Berlin Finsen Institute, has succeeded in employing alternating current to induce sleep and anaestesia without injury to the patient, the margin between an adequate "dose" and the amount necessary to cause death being much greater than in the case of direct current.

An Electrical Scaling Machine.—A demonstration was given a few days ago at Messrs. Swan, Hunter & Wigham Richardson's dry-dock at Wallsend-on-Tyne, of a new machine for scaling ships' plates, which is claimed to be equally efficient in scaling the internal surfaces of boilers, &c. The machine is manufactured by the Electrical Engineering and Equipment Co. The demonstration took place on the outer skin of the Russian volunteer ship under repairs at the docks. The tool consists of four steel wheels, similar to milling cutters, and the driving power is a small electric motor, power being conveyed through a flexible shaft to the cleaning tool. The motor has a speed of from 1,000 to 1,500 R.P.M. When the power is applied the cutters fly from the centre rotating at a high speed and when applied to the scale it is instantly removed. The patentee of the machine was pitted against an expert worker with a pneumatic tool, and the result was that the electric cleaner accomplished in four minutes what it took six minutes to do with the pneumatic tool. There was a large attendance of official representatives from the neighbouring shipyards.

Manchester Electro-Harmonic Society.—The first meeting of the session of the Manchester Electro-Harmonic Society was held on Friday last at the Albion Hotel, Manchester, when about 150 members and friends were present. The president, Mr. S. L. Pearce, in opening the proceedings, said he was glad to see so many present. Since the inaugural concert in the spring, there had been an increase in the membership, and everything promised for a successful future. At the time of the last concert there was a membership of 70, but the membership to-day stood at 123, and there were also about 25 vice-presidents. That showed an increase of 53. The concert, which was given under the management of Mr. W. J. Smith (hon. musical director), was of a very high order, and was much appreciated by the members present. The next concert is fixed for Friday, November 29th, and good artistes have been engaged.

Institution and Lecture Notes.—Institute of Marine Engineers.—At a meeting held on October 14th, Mr. Summers Hunter, the new president, dealt with various questions connected with the past, present, and future of marine engineering. He made reference to the electrical propulsion of ships, and said that it had been so far exploited chiefly by Americans, but the Clyde and the Tyne were both again to the fore in this new development, with which the name of Mr. William P. Durtnall would always be associated. He mentioned the electrically-driven vessel *Jupiter*, which the American Government were fitting up, and also a vessel being built by Messrs. Swan, Hunter & Wigham Richardson, at Newcastle, of 2,400 tons dead-weight capacity, the latter vessel being driven by two Diesel oil engines, electrically geared to the propeller by the use of the polyphase A.C. system.

Rontgen Society.—The report of the Council for the past year shows that the revenue fell short of the expenditure, the deficit being met from reserves. Sir James Mackenzie Davidson is the new President, and Mr. C. E. S. Phillips hon. treasurer, Dr. F. H. Low continuing as hon. secretary.

Junior Institution of Engineers.—The annual meeting is to be held on Wednesday, November 13th, at 7 p.m., at the I.E.E. Building, Victoria Embankment.

The Polytechnic, Regent Street, W.—The first of the special series of lectures on illuminating engineering was delivered on Friday last. Mr. W. C. Clinton, of University College, gave a brief account of the fundamental laws of light and colour, and showed some interesting experiments illustrating the appearance of coloured objects illuminated by the arc lamp, the mercury vapour lamp, and the neon tube. The next two lectures of the course, on November 1st (to-day) and November 8th, will deal with electric lighting, and will be illustrated by lantern slides and exhibits of the latest types of lamps.

Institution of Electrical Engineers (London).—The dates announced for London meetings during the 1912-1913 session, which opens on November 14th with Mr. Duddell's presidential address and the presentation of premiums, are as follows:—

November 28th	February 13th and 27th
December 12th and 19th	March 6th and 13th
January 9th and 23rd, 1913	April 10th and 24th
	May 1st and 22nd

Spanish Government Supplies.—Referring to foreign supplies to Spanish Government Departments, the *Gaceta de Madrid* of October 1st publishes several alterations in the list of articles in the requisition of which the Spanish Ministry of War and Ministry of "Fomento" may permit foreign competition. The more important additions to the list include gasoline, lubricating oils, sectional iron, steel, high-class machine tools, heavy wood-working machines, leather-working machines, telephone apparatus, small crucible furnaces, electric furnaces for tempering and fusing metals, appliances for extracting foul air, water meters, surgical and medical apparatus of all kinds, apparatus and luminants for lighthouses, special light and sounding buoys. There is no change in the other Government Departments' lists of material for the supply of which foreign competition is admitted. These lists may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal.*

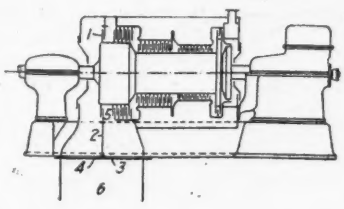
Electric Clocks.—The placing of an electric clock outside certain premises at the corner of High Street, Clapham, and Venn Street, to advertise an electric theatre, was held by the Court of Appeal this week to be a projection bringing forward the front of a building. The matter came before the Court upon an appeal by the Electric Palaces, Ltd., from an order made by Mr. Justice Joyce in an action brought by the lessors, A. C. Jones & Co., Ltd. The Electric Palaces, Ltd., were, by the terms of their lease, under covenant not to make any alterations to the front, nor by means of any projection to bring forward the front of certain rooms above a shop in the occupation of Jones & Co., at the corner of High Street, Clapham, and Venn Street. The rooms in question were used for the purpose of advertising an electric theatre in Venn Street, but Mr. Justice Joyce held that the erection of the clock was a breach of the restrictive covenants of the lease, and this view was upheld by the Master of the Rolls and Lords Justices Farwell and Hamilton.

Appointments Vacant.—Assistant electrical engineer, for the Bray U.D.C. (£104); switchboard attendant, for the Portsmouth Corporation (25s.); clerk, for the Swindon Corporation Electricity and Tramway Departments (£70); electrical fitters and armature winders, for H.M. Dockyard, Devonport (36s.). See our advertisement pages in this issue.

The Aluminium Price Advance.—According to statements emanating from aluminium trade circles in Germany and Switzerland, an exceptionally large demand has arisen for aluminium, and it seems as if the upward movement in prices will develop into a general rise. The consumption experienced a large increase in 1910, whilst further progress of considerable extent took place during the severe contest which preceded the recent reconstitution of the International Syndicate. At present the call for articles for military equipment in the Balkans is very active, and the whole of the production of aluminium in the United States is being absorbed by domestic consumers. As contrasted with the present brisk demand, it has to be remembered that the production of the companies using water-power in the Alpine districts is directly influenced by the situation of the water in the winter. The price of ingots has already reached the stage of £85 per ton.

Electricity Supply.—A small private electricity supply business, which has been running for some seven years, is hampered by want of capital for extensions. As the district has never been canvassed, there is probably fair scope for development, if any reader cares to take it up.

Steam Turbines with "Exhaust Disks."—In the *Revue de Mécanique*, M. Delaporte recently pointed out that there is a certain pressure limit beyond which the turbine ceases to benefit by any further expansion. If, however, part of the exhaust steam is removed to the condenser at that pressure, the remainder can be further expanded in the turbine with advantage. On this basis a turbine has been constructed with an additional set of blades called the "exhaust disk," 1 in the figure below, through which



five-eighths of the steam is allowed to pass, the rest being diverted into the condenser 6 by the diaphragm 2 and guide blades 5. By this means nearly 4 per cent. extra power is gained. A further advantage can be secured by continuing the diaphragm 2 so as to divide the condenser into two chambers corresponding to the passages 3 and 4, though the circulating water is provided by a pump common to both. The pressure in compartment 4 is lower than that in 3, and a resulting increase in efficiency of 6·8 per cent. has been recorded in actual tests.

Electrical Production of Steel.—It was mentioned at the recent meeting of the R. Lindenberg Steel Works Co., of Remscheid-Hasten, that the Witkowitz Iron and Steel Co. have taken a licence for the Lindenberg process for the electrical production of steel. This is the first large Austrian company which has embarked on the manufacture of steel by electricity, and it is considered probable that other Austrian steel-makers will follow the example in the future. The Gelsenkirchen Co. has recently ordered a furnace for its large works at Esch, Luxemburg, which is intended, in the first place, for the smelting of ferro-manganese. During the past two months the Lindenberg Co. has brought into operation an electric furnace of 25 tons capacity, which is claimed to be the largest hitherto built. The furnace is charged with 28 tons, and works in conjunction with two Bessemer basic converters, in the sense that the charge consists of molten metal, which is unfinished basic steel. Although the furnace has only been in regular operation for a few weeks, the results already obtained are said to confirm the opinion of the directors that it will be possible, with large furnace units, to produce electrical steel more cheaply than the open-hearth quality.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Ilford U.D.C. has appointed Mr. George Francis Gregory, second charge engineer at the electricity works, as outdoor superintendent, and has increased the salary of the electrical engineer (Mr. A. H. Shaw) from £475 to £500, as from Michaelmas last.

Mr. J. P. Robson has been appointed assistant electrical engineer to Shipley U.D.C.

The Liverpool Tramways and Electricity Committee is making a recommendation to the City Council asking for authority to arrange for the retirement of Mr. Alfred Clough (resident electrical engineer), at a rate to be mutually agreed upon, and that in the special circumstances of the case a superannuation allowance equal to one-half of his present salary, be paid to him from the date of his retirement. Mr. Clough, who was associated with Mr. A. B. Holmes, in the direction of the Liverpool electricity undertaking, has been receiving a salary of £1,100 per annum.

Mr. Harold Gray, borough electrical engineer, Accrington, has sustained a sad bereavement by the death of his wife, which took place suddenly, at the age of 29, only 4½ months after marriage. Many of our readers will desire to join us in an expression of deep sympathy with Mr. Gray.

Mr. W. Thompson, senior switchboard attendant to the Walthamstow undertaking, has been appointed charge engineer for three months on trial.

Mr. R. E. McDonnell has resigned his position as electrical engineer at Bray. The Council recently decided to grant him a bonus of £30, and to advertise the position at £2 per week Mr. McDonnell to be given preference if he applied for the post.

Tramway Officials.—On the 25th ult. Mr. Andrew Nance, manager of the Belfast Corporation tramways, was presented by the staff of the undertaking with an illuminated address in acknowledgment of his work in instituting a scheme of bonuses for workers. Mr. Nance, in reply, said the Corporation were precluded from anything in the nature of co-partnership or profit-sharing, but they had been able to institute a system of co-operation by which every member of the staff participated in a bonus which depended for its amount on the profits of the undertaking.

General.—Mr. Thos. J. Sack has resigned the post of works manager to the Micanite and Insulators Co., Ltd., to take up a similar position with the Electrical Apparatus Co., Ltd., of London. He has been presented with a marble clock, suitably inscribed, by the employés of the Micanite and Insulators Co., Ltd.

The marriage took place at St. Robert's Church, Harrogate, on October 23rd, of Mr. Wm. O. Pepper, of Shipley, Bradford, and Miss Blanche M. Tindall, daughter of Mr. John Tindall, of Harrogate.

Mr. N. A. Saltmarsh, late manager at Watford, for the National Telephone Co., has been transferred to Southend-on-Sea.

A South African contemporary states that Mr. M. I. Williams-Ellis recently returned to the Rand to act as representative-in-chief at Johannesburg for Messrs. Sandycroft, Ltd. Mr. Herbert Briggs will continue to act for the company in a consultative and advisory capacity.

Mr. A. E. Mohring, chief of the export department of Messrs. Crompton & Co., Ltd., has left England for a short business tour in India. He will be away for about three months.

Obituary.—We regret to learn that Mr. Charles K. Falkenstein died on October 23rd, at his residence, Homeleigh, Lanercost Road, Tulse Hill Park, S.W., at the age of 75 years, after a prolonged illness. His indisposition, however, did not prevent him from being actively engaged in business until within less than four weeks of his death. Mr. Falkenstein had been closely interested in ebonite practically from the time of its introduction into this country, both as regards its manufacture and its application to electrical and other purposes. He had been associated with the Britannia Rubber and Kamptulicon Co. since 1864, first at their works at Bow Common, and later in the City of London. The funeral service was at Christ Church, Streatham Hill, on Saturday last, 26th ult., the interment taking place at Streatham Cemetery, Tooting, in the presence of a number of Mr. Falkenstein's friends, and many beautiful wreaths and other floral tributes were received. The deceased gentleman leaves a widow and an only son, Mr. Conrad K. Falkenstein, A.M.I.E.E., to whom we desire to extend our sympathy in their bereavement.

NEW COMPANIES REGISTERED.

Coventry Electric Clock Co., Ltd. (124,954).—This company was registered on October 24th, with a capital of £15,000 in £1 shares (10,000 preference), to carry on the business of manufacturers of and dealers in electrically-driven clocks, watch-works and machinery, &c., to acquire from H. G. Coventry and T. Rushton the benefit of certain existing inventions relating to electrically-driven clocks or watch works. The subscribers (with one share each) are:—H. G. Coventry, 152, Gray's Inn Road, W.C., civil engineer; T. Rushton, 24, Salisbury Road, Upper Holloway, N., electrical clockmaker. Private company. The number of directors is not to be less than two or more than five; the first are H. G. Coventry (permanent director and chairman; special qualification, £300 shares); and S. E. Barron; qualification of ordinary directors, £100 shares. Registered office, 152, Gray's Inn Road, W.C.

Rotherham Electrical Engineering Co., Ltd. (124,964).—This company was registered on October 24th, with a capital of £2,000 in £1 shares, to carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, &c., and to adopt an agreement with S. Walford-Grout and J. E. Tongue. The subscribers (with one share each) are:—S. Walford-Grout, Horinglow, Burton-on-Trent, engineer; J. E. Tongue, The Poplars, Regent Street, Rotherham. Private company. The number of directors is not to be less than two or more than three; the first are S. W. Grout (chairman) and J. E. Tongue (both permanent governing directors, subject to holding £500 shares). Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

Llanelly Motor and Electrical Engineering Co., Ltd. (124,961).—This company was registered on October 24th, with a capital of £5,000 in 900 preferred ordinary shares of £5 each and 500 founders' shares of £1 each, to carry on the business of manufacturers of and dealers in motor-cars, motor-cycles and motor-propelled carriages, omnibuses, machines and vehicles of all kinds, electrical and mechanical engineers, manufacturers of and dealers in electric light and electrical apparatus, &c. The subscribers (with one preferred ordinary share) are:—C. G. Ace, 92, Murray Street, Llanelly, auctioneer; L. L. Pugh, 21, Talbot Street, Cardiff, insurance manager; W. P. Rees, Great Western Terrace, Llanelly, secretary; D. Pearson, 1, Sandy Terrace, Llanelly, foreman; W. E. Clement, Ryecroft, Queen Victoria Road, Llanelly, iron merchant. Private company. The number of directors is not to be less than two or more than five; the first are C. G. Ace, L. L. Pugh and D. J. Evans; qualification, £100. Solicitor, D. Jennings, Cowell Street, Llanelly. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

British Ackley Brake and Supply Co., Ltd. (124,932).—This company was registered on October 23rd, with a capital of £10,000 in £1 shares, to carry on the business of mechanical engineers and manufacturers of and dealers in apparatus capable of being used in connection with brakes and other railway and tramway supplies, &c., and to adopt an agreement with G. S. Ackley. The subscribers (with 40 shares each) are:—G. S. Ackley, 2, Norfolk Street, Strand, W.C., manufacturer; E. E. Daglish, 2, Norfolk Street, Strand, W.C., engineer; W. L. Larkin, 2, Norfolk Street, Strand, W.C., engineer. Private company. The number of directors is not to be less than three or more than five; the first are G. S. Ackley (chairman and governing director, subject to holding not less than 300 shares), E. E. Daglish and W. L. Larkin; qualification, 20 shares. Registered office, 2-3, Norfolk Street, Strand, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Cleveland and Durham Electric Power, Ltd. (89,539).—Return dated October 14th, 1912. Capital £700,000, in 350,000 pref. and 350,000 ord. shares of £1 each; 333,705 pref. and 157,600 ord. shares taken up; £1 per share called up on 331,935 pref. and 79,608 ord.; £411,603 paid; £80,802 considered as paid on 1,770 pref. and 78,532 ord. (with exception of £6 5s. paid in cash). Mortgages and charges: £340,000.

CITY NOTES.

National Telewriter Co., Ltd.

The directors' report for the period from May 23rd, 1911, to June 30th, 1912, states that the agreement with the American company alluded to in last year's report has been completed. The latest types of instruments are giving every satisfaction. The rent roll of the company has increased by about 50 per cent. during the six months prior to the date of this report, and substantial reductions in expenditure have been effected. These benefits, however, were not secured in time to have an appreciable effect upon the accounts now presented to the shareholders.

The third annual general meeting was held on Wednesday, at the Cannon Street Hotel, E.C., Sir George Craggs presiding.

The Chairman, in moving the adoption of the report, said that owing to enforced absence abroad at the beginning of the year, Mr. E. W. W. Edwards resigned his position as chairman, and his colleagues invited him to take that position. As they knew, he held the largest interest in the company, and they would feel that that was a guarantee that his best services, like those of his co-directors, would be devoted to the interests of the shareholders. Mr. T. Bernbaum on the termination of the arrangement made with him, took up the foreign and Colonial development which promised well. Some excellent business had already been done, for which they were much indebted to him. That was the third ordinary general meeting of the company, and the board regretted that the accounts for the 13 months to June 30th did not show better results, although they were a considerable improvement on those of the previous years. The figures now before them did not represent the position of the company at the present moment; all conditions had greatly improved since they were made up. They had added to the rent roll, and had also effected considerable reductions in expenditure, and he felt confident that when the directors came before them next year it would be with better results. Since becoming chairman he had given additional time to the supervision and conduct of the business. Reductions in working expenses, however, could not be carried out immediately they were decided upon, nor could business obtained be included, although the expenses of obtaining that business had been paid. For instance, after they had received an order from a subscriber there was a lapse of time between the date of order and its fulfilment, chiefly on account of the delay in the provision of the wires for the service by the Post Office. Thus some of the business that had been obtained prior to June 30th did not come into the present accounts, and such of it as was included counted only for a short period of the year under review. Although, of course, they received payments in advance, yet only that proportion that was actually earned from the date of installation to June 30th came into the credit of the profit and loss account. They would better appreciate the point when he explained that during the past six months they had increased their annual rentals by nearly 50 per cent., but that, owing to the reason stated, almost the whole of this new business did not become operative until the current financial year. In the accounts for last year the amount transferred to suspense account was £5,790. If these accounts had been for a year and 38 days to correspond with the period covered by the present accounts, the figure would have been £6,400. This year it was £4,345, which was much better, though still not satisfactory. Expenditure on capital account during the period for instruments, construction of exchanges, plant, &c., was £5,652, as against £6,779 for the previous year. Cash in hand at the end of the period amounted to £13,059 16s. 9d. The value of rentals carried forward was £1,463, as against £1,118 for 1911. They had heard a good deal about the instruments at previous meetings. He was glad to be able to say that they were working well, and their subscribers were satisfied. The technical improvements spoken of by the chairman at last year's meeting, both as regarded the American instruments for private lines and the British instruments for the exchange, had proved to be of considerable value, and great advances had been made in their efficiency. The London exchange was going ahead in a satisfactory manner. Many thousands of telegrams were being transmitted week by week between the Central Telegraph Office, the cable companies, and their subscribers, and there were a number of firms who found it of considerable use in the transaction of their business, and they hoped before long it might form a general means of intercommunication between buyer and seller, and between various firms who had business relations with each other on a much larger scale. Having regard to the accuracy of transmission, the permanence of the records and the saving of time and money effected by the instrument in the business of a number of leading commercial houses, it was a matter of great surprise to the board that the general adoption of the Telewriter was not quicker. They had a number of satisfactory installations in Liverpool and in Manchester, and they

were well situated in those two towns for carrying on business. In view of that they had decided forthwith to open an exchange in Liverpool. A new exchange had been opened in the West End in order to facilitate communication between West End and City houses. Proceeding to give particulars of some of the individual installations, the chairman said that one had been supplied to the Allan Line for one of their steamers sailing between Liverpool and Montreal, the transmitting portion of which was situated in the Marconi room, and the receiving portion in the chart room, so that all wireless messages as they were coming in were immediately transmitted to the proper quarter. That was an important adjunct to the Marconi apparatus on ships, which should before long be realised by shipowners and others who were interested. Several receivers could, if required, be operated by one transmitter, and the messages received be simultaneously delivered to different parts of the ship. There were many directions in which the instruments would be of great use to the Army and Navy, and they hoped some day the authorities would realise it. Arrangements had been completed for mutual working with the several American companies who owned nearly all the patents of the Telewriter outside the British Isles.

Mr. E. B. Ellice Clark seconded the motion, and it was carried without discussion.

Edison & Swan United Electric Light Co., Ltd.

The directors' report for the year ending June 30th, 1912, is as follows. We have inserted the figures from the previous year's report in italics :—The net revenue account shows that £42,820 (*£49,154*) has been brought forward from profit and loss account. Interest on debenture stocks has absorbed £15,702 (*£15,702*); £5,500 (*£5,500*) has been set aside as depreciation on freehold and leasehold property, plant and tools; £7,500 (*£7,500*) has been applied in writing down values of stocks; £2,225 (*nothing*) has been written off the expenditure on foreign branches, trade marks, and experimental account; and £1,447 (*£1,439*) has been reserved on account of bad and doubtful debts. The result as shown in the net revenue account is a credit balance of £10,446 (*£19,010*), to which must be added £8,356 (*£6,843*) brought forward, thus making a total of £18,802 (*£25,856*). Of this amount the directors propose to place £10,000 (*£17,500*) to reserve fund, carrying forward the balance £8,802 (*£8,356*). Cost of establishing the business, goodwill, &c., £390,432 (*same*), has been brought forward at the figure standing in the last balance-sheet. The freehold and leasehold property and plant have also been brought forward at the value stated in the last balance-sheet, with the addition of the amount expended to June 30th, 1912, less depreciation charged in net revenue account. The Altrincham Electric Supply, Ltd., shows encouraging progress in its lighting business generally. In addition it has entered into an important contract for the supply of power, which will come into operation in the beginning of 1913. The usual dividend has been paid on its shares. This company has applied for, and has had allotted a further 5,000 £1 shares fully-paid in this undertaking. Its indebtedness to this company has been reduced during the year by £5,392 on current account. There has been expended on capital during the year ending June 30th, 1912, £6,226 (*£5,361*), largely on account of extensions to plant in connection with the engineering works. The directors have given careful consideration to the question, and having due regard to the requirements of the business, have decided not to recommend the payment of a dividend on the shares on the present occasion. (*Last year it was stated that trading showed satisfactory progress.*) The annual meeting is called for November 7th.

Cape Electric Tramways, Ltd.

Mr. Ludwig Breitmeyer (chairman) presided on Wednesday at the offices, London Wall, E.C., over the meeting of this company.

In moving the adoption of the report, the Chairman said the returns for both Cape Town and Port Elizabeth again showed a substantial improvement on the previous year's figures, and justify the hope that he expressed last year that the company would be able to increase its dividend. The increased profit enabled the directors to recommend the payment of a dividend of 5 per cent., free of income-tax, on the ordinary shares of the company, besides again placing £8,000 to reserve account, and carrying forward a balance of over £4,000 to next year's account. They had carried nearly a million passengers more than in the previous year with increased receipts of about £8,000, and there was every indication in the months that had elapsed since the close of the financial year, these figures were being more than maintained in the current year. This was very important, and he wanted to impress them with it. The directors were very gratified to be able to recommend a dividend which was double that of last year. In order to do this, they had had to appropriate a portion of the profit carried forward from the previous account. The board, however, felt justified in making this appropriation, as the monthly returns in the new financial year since July 1st last showed advances again, and they had no doubt that this small encroachment would be more than recovered in the current year. At the same time, it must be borne in mind that the plant was getting older, and that the reserve fund would require strengthening in the future by some additional appropriation. Though they had every reason to look forward to a continued increase in the traffic returns, he anticipated that the greater portion of that increase for the next year or two would be required for the purposes he had mentioned. The reports from the general managers of Cape Town and Port Elizabeth placed the shareholders in possession of full details regarding the working of the systems during the year under review. In conclusion, he might add that the outlook generally was satisfactory. Cape Town had survived the removal of the Administration to Pretoria remarkably well, and had now, according to the recent address of the retiring Mayor, firmly established itself as the real Capital of the Union, and general business conditions there showed a promising development. In Port Elizabeth also the business outlook had further improved; both exports and imports showed good increases. The energetic Town Council of that port were undertaking sundry important measures to enhance the attractiveness of the place as a seaside resort for up-country residents, which were sure to bring many visitors to the place, and their tramway business would undoubtedly reap its share of the benefits of these improvements.

Admiral Sir A. Hastings Markham seconded the motion.

Mr. Theophalis asked what had been done with regard to the running of motor-'buses in Cape Town, to which he drew attention at the last meeting.

The Chairman said they had a few 'buses running, and the experiment looked to be a good one, but he would prefer to make a fuller statement at the next meeting. They could not run them on the Dock Road because of the bad state of that road, which was now being remetalled.

Mr. May said he understood they were running 'buses from the Green Point round the Kloof just as feeders to the tramways, but in view of the state of affairs in London, he thought the board ought to keep their eyes open to see that no other company came in with 'buses and took the tramway traffic from them. It might be a serious matter.

The Chairman said the directors were fully alive to that eventuality, and that was the reason why they had gone in for 'buses, but it must be remembered that the conditions of London and Cape Town differed greatly. There were heavy gradients in Cape Town which made it difficult to run 'buses, and there was no County Council to spend millions of money on the roads. Consequently motor-'buses were not the same danger to the tramways in Cape Town as in London.

Mr. May said he realised this, but the 'buses would run on the roadway of the tramways. What he meant was that if 'buses were to come in the company might as well run them themselves.

The Chairman said that was the reason why they had started them, and so far they had no competition. Of course, competition might come, but at any rate they would be in a position to deal with it.

Mr. Walker asked if there was anything to report about the Sea Point Railway.

The Chairman said it was in the same position as a competitor as before, but, as the conditions were more prosperous in Cape Town, they had attracted passengers who were content to pay 1d. more on the tramways. The railway had to run four or five years more under the present conditions, and then the Government would take it over.

The report was adopted, and, on the motion of Mr. Fuller, the sum of 1,200 guineas was voted to the board as their remuneration for services during the past year. Last year £800 was voted.

West India and Panama Telegraph Co., Ltd.—The report of the directors for the half-year ended June 30th states (says the *Times*) that the revenue amounted to £46,718, against £47,318 for the corresponding half-year of 1911, and the expenses were £27,110, against £25,329, leaving a balance of £19,608, to which is added £1,559 interest on investments, and £2,018 brought forward, making a total of £33,185. The directors have placed £2,000 to reserve, and they propose to pay a dividend on the ordinary shares of 1s. 6d. per share, free of tax, leaving a balance to current half-year's account of £2,791. The traffic receipts show a decrease of £487, as compared with the corresponding period. The expenses of repairing cables, charged to revenue, amounted to £8,611, as compared with £6,897. This is exclusive of an expenditure of £3,022, which has been charged to reserve, in respect of 42 knots of new cable used in the repair and partial renewal of the Jamaica-Ponce and of the Jamaica-San Juan sections.

Continental.—France.—La Société des Ateliers de Constructions Electriques du Nord et de l'Est, of Paris, is increasing its capital from £1,000,000 to £2,000,000.

Messrs. Dupont & Co. Société d'Eclairage Electrique des Automobiles is the name of a new company which has lately been formed in Paris with a capital of £5,000.

Perth Electric Tramways, Ltd.—The directors have called extraordinary meetings for to-day to consider their proposals for the sale of the undertaking to the Government of Western Australia. It seems that the Government offer is £25,000 less than was asked by the company, but the company has had another full year's profits which exceed that amount. In their circular the directors state a number of reasons why sale to the Government is a desirable course to adopt, yielding a handsome return to the investors.

Western Telegraph Co., Ltd.—The directors, after transferring £145,000 to the general reserve fund, £10,000 to the land and buildings depreciation fund, and £15,600 to the provision on account of investment fluctuations, recommend a final dividend of 3s. per share, making with the previous distributions, a total dividend of 6 per cent. for the year to June 30th, and a bonus of 2s. per share.

Cape Electric Tramways, Ltd.—The directors have declared a dividend of 5 per cent. free of income-tax.

Singapore Electric Tramways, Ltd.

Sir Frank Swettenham presided over an extraordinary meeting of the above company, held at 19, St. Swithin's Lane, E.C., on Tuesday, for the consideration of the following resolution :—"That the capital of the company be reduced to £100,000, and that such reduction be effected by cancelling paid-up capital which has been lost, or is unrepresented by available assets, to the extent of 15s. per share on each of the 400,000 issued shares of £1 each of the company, and by reducing the nominal amount of each of the said shares to 5s."

The Chairman, in moving the resolution, said the board had thought it advisable to call the meeting, because the principle of reduction of capital had already been agreed on at a previous meeting. At the previous meeting it was decided that they should write off 12s. 6d. a share, and they made that proposal because the manager had cabled that the valuation of the undertaking and plant was £425,000. When the valuation arrived in this country the board felt it necessary to question it, and they referred it back to the manager for details, with the result that the manager gave the reduction at £381,642. With that before them, the board felt it very advisable to make the shares 5s. instead of 7s. 6d. One shareholder had made a small objection, as he thought they were incurring further expense by making the further reduction, but that was not the case, because they had not done anything with the previous resolution, and therefore the expense, which in any case would be very small, would not be practically increased by this amended resolution.

Mr. E. Davis seconded the resolution, and it was carried without discussion.

Ferranti, Ltd.

The seventh annual general meeting was held on Thursday last week at Basildon House, E.C., Mr. A. W. Tait presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 629), said that the profit for the year to June 30th, 1912, was £51,759, showing an increase of £2,865, and the net profit, after providing for general establishment charges, repairs and renewals, legal expenses, bad debts and directors' and trustees' fees, was £24,333, as compared with £22,045. During the five years from 1908 to 1912 the assets of the company had increased by £89,703, this increase being mainly represented by—increase in plant, machinery and tools, £21,916 ; expenditure on work in hand, £37,750 ; stocks and stores, £6,529 ; book debts, £26,650 ; and buildings, £4,135. The increase in the company's liabilities during the same period was £41,610. He was sure that the shareholders would recognise that this was a very substantial improvement in the company's position. The results for the year under review were not only satisfactory in themselves, but were really better than they appeared, owing to the fact that during that period there was considerable labour unrest, which naturally affected the cost of production and the total output. They would remember that in the summer of 1911 they had the railway strike, followed by the dock strike, and at the beginning of this year they had the coal strike. Those troubles necessarily added to the cost of fuel and carriage, apart from the consequent disorganisation of business. Nevertheless, the company was able to show a record in output, as well as in profits, and the current year, so far as it had gone, was decidedly encouraging, and there was reason to believe that if there were no unforeseen set-backs, the result should be at least as favourable. They would appreciate, however, that the expanding nature of the company's business had necessitated, and would necessitate for some time to come, the absorption of further working capital, and they would observe from the report that it was the intention of the directors to issue £50,000 five-year 6 per cent. notes, secured on £50,000 first mortgage debentures. At the last annual meeting authority was given for the increase of the borrowing powers, and negotiations were entered into with a view to placing the debenture stock, but it was found that, owing to the state of the market and the present unpopularity of electrical securities, it was impossible to place the issue, except at a very considerable sacrifice. The directors therefore consulted several of the parties largely interested in the company, and it was decided to obtain the necessary working capital required by the issue of five-year notes. The proceeds of the issue would be applied to redeeming the balance of the prior lien debentures, which stood at the figure of £16,100, and the redemption of temporary loans, which amounted to £19,122, and the balance would be applied as further working capital for the company. It was, however, a term of the issue that during the period of the notes, such profits as the company might make after payment of the interest and sinking funds on the first and second debentures, and the note issue, would be accumulated as reserve, and, therefore, available as further working capital for the company. It would, therefore, be seen that during this period the company would be unable to declare dividends on its shares. But, although this might be unpleasant news for the shareholders from the point of view of revenue, they should take into account the strengthening of the position of the company generally, in which they were so largely interested, and the consequent increase in the capital value of their security. They would observe from the accounts that at June 30th, 1912, the company had accumulated in the form of depreciation reserves, a sum amounting to £47,350, and if the company made the same comparative progress during the next five years, the position of the shareholders would have enormously improved. He hoped by that time they would be able to make arrangements which would compensate the preference shareholders for their long period of waiting, and to then commence and continue the payment of regular dividends. The company had in the past received every encouragement and support, not only from its shareholders, but also from its debenture-holders, because, as they were probably aware, under the terms of the trust deed, sinking funds for the redemption of the first and second debenture issues should have been in operation from the commencement of the new company's operations, but as the money was required for the development of the company's business, the debenture-holders had up to now agreed to the waiving of their rights in that connection. The directors now felt that the time had arrived when they were able to carry out that obligation, and, therefore, from the end of this year the sinking funds on these debenture stocks would be put into operation, and the gradual redemption of stock by the application of these funds would still further improve the position of the shareholder. With regard to the business generally, he said the various departments were in a flourishing, as well as an efficient, condition. Every department showed considerable progress during the year, and the expansion of the meter and switch business was decidedly encouraging. With regard to the meter business, they had made arrangements for the efficient working of the Ferranti C.C. meter on the Continent, which would be of considerable advantage to the company, and their business in Canada was not only a profitable one, but showed signs of healthy expansion, and their sales in other parts of the world were encouraging. The switch department was now standardised for the manufacture of all classes of switchgear, and the orders which the company had received showed that the merit of the company's work was appreciated. They had during the year developed certain lines in cooking and heating apparatus which were likely to be valuable adjuncts to the company's business. That record of progress was a good and sufficient answer to the absorption of working capital which was taking place and the necessity for conservative measures if progress was to be maintained and increased. At the present time the company's works were employed to their fullest capacity, and it had been necessary to lay down extensions of certain departments of the company's business to meet these requirements. He felt sure that the shareholders would appreciate the explanations which had been given, and would approve the policy which the board had carried out and which they recommended should be continued for some little time as the benefits would all accrue to their ultimate advantage.

Mr. J. M. Henderson seconded the motion.

Mr. Nalder asked what possibility there was of paying a dividend in the near future, and the Chairman, in reply, said that the directors had considered the possibility of paying some interest to the shareholders, but if they wanted the business to progress they would have to wait a little longer, and then they would have an excellent paying business.

The report was adopted.

Cuba Submarine Telegraph Co., Ltd.

The directors' report for the half-year ended June 30th last, states that the total receipts of the six months were £23,722, while the expenses amounted to £7,834, leaving £15,887, plus £7,656 brought forward, giving a total of £23,543 to be dealt with. The sum of £2,000 has been placed to the reserve against loss on investments, £4,000 added to the reserve fund, which now stands at £92,000, and £2,000 to the pension fund. The dividend on the preference shares will absorb £3,000, and leave £12,543, out of which the directors recommend the payment of a dividend at the rate of 6 per cent. per annum on the ordinary shares, free of income-tax, the balance, £7,743, being carried forward. The cables continue in good working order. A scheme of pensions for the employés of the company has been prepared by the directors, which, subject to the sanction of the shareholders, they propose to carry into effect, and £2,000 has been reserved in the half-year's account to establish the fund for this purpose.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Brisbane Electric Tramways Investment Co., Ltd —Further issue of 15,000 ordinary shares of £5 each, fully paid (Nos. 75,001 to 90,000).

Consolidated Cities Light, Power and Traction Co.—Fully-paid scrip for $4,000,000 first lien 5 per cent. gold bonds.

To appoint a special settling day in :—

Compania de Electricidad de la Provincia de Buenos Ayres, Ltd.—Further issue of £150,000 5 per cent. first mortgage gold bonds of £20 each (Nos. 37,501 to 45,000).

And to allow the following securities to be quoted in the Official List :—

London Electric Supply Corporation, Ltd.—Further issue of £100,000 4 per cent. first mortgage debenture stock.

The Committee have appointed special settling days as under :—

Wednesday, November 6th.—Bolton (Thomas) & Sons, Ltd.—£300,000 5 per cent. first mortgage debentures of £100 each (Nos. 1 to 3,000) (registered).

Synthetic Products Co., Ltd.—80,830 cumulative participating preferred shares of £1 each, fully and partly (10s.) paid (Nos. 1 to 7 and 25,008 to 105,830).

United River Plate Telephone Co., Ltd.—Further issue of 40,000 ordinary shares of £5 each, fully and partly (£2 10s.) paid (Nos. 230,001 to 270,000).

Thursday, November 7th.—Brazilian Traction, Light and Power Co., Ltd.—1,003,614 shares of $100 each, fully paid.

And ordered the undermentioned securities to be quoted in the Official List :—

Bolton (Thomas) & Sons, Ltd.—£300,000 5 per cent. first mortgage debentures of £100 each (Nos. 1 to 3,000) (registered).

Brazilian Traction, Light and Power Co., Ltd.—1,003,614 shares of $100 each, fully paid.

United River Plate Telephone Co., Ltd.—Further issue of 40,000 ordinary shares of £5 each, £2 10s. paid (Nos. 230,001 to 270,000).

Allgemeine Elektrizitäts Gesellschaft.

The directors of the A.E.G. state that, after deducting general expenses, taxes, depreciation, interest on loans and the cost (£53,000) of the last issue of bonus, the net profits earned exclusively from manufacturing amounted to £1,219,000 in the financial year ended with June 30th, 1912, as compared with £1,107,000 in the preceding year. At the general meeting on December 3rd it is proposed to recommend the payment of a dividend of 14 per cent. on share capital of £6,500,000, as contrasted with 14 per cent. on £5,000,000, and 7 per cent. on £1,500,000 in 1910-11. Apart from the provision made for depreciation, according to the practice hitherto followed, it is intended to place £150,000 to the reserve fund, which thus becomes increased to £3,250,000, or the equivalent of one-half of the share capital. The turnover invoiced in the first two months in the new financial year, and the orders on hand, show a considerable increase, as compared with the corresponding period in the previous year. The following table indicates the developments which have taken place in recent years :—

	Net profits.	Amount distributed.	Percentage dividend.	Placed to reserve fund.
1906-7 ...	£743,000	£600,000	12	£50,000
1907-8 ...	796,000	600,000	12	50,000
1908-9 ...	819,000	650,000	13	63,000
1909-10 ...	921,000	700,000	14	100,000
1910-11 ...	1,107,000	805,000	14	118,000
1911-12 ...	1,219,000	910,000	14	150,000

The directors, as in previous years, refrain from giving any intimation as to the amount of profits obtained from the financing side of the business, and, consequently, of the sums derived from this source to the strengthening of the internal reserves. It is now proposed to make a fresh issue of £1,250,000 in ordinary shares, in order to maintain the "liquidity" of the company. The shares are expected to be offered at the price of 210 per cent., which will permit of a further allocation of about £1,250,000 to the reserve fund.

Monte Video Telephone Co., Ltd.

The annual ordinary meeting was held on October 23rd at Winchester House, E.C., Mr. Charles Lock presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 629), said that the year under review gave them a gross revenue from subscriptions, rentals, and transfer fees of £61,556, compared with £52,553 last year. The reason for that very considerable increase was that during the past year they had included the gross camp receipts because they had taken over that system as from the commencement of the year, whereas in the previous year they only took into the receipts the net amount received from the then lessee. The working expenses with the larger number of subscribers, had naturally shown a fairly large increase, and they had also to meet exceptionally heavy expenditure in the shape of repairs to damage caused by storms, which, he was sorry to say, they were never quite free from in Monte Video. They had also had to expend a considerable sum in dealing with the repairs to the Camp system, which was taken over from the lessee towards the end of the last financial year. He believed, however, that the results from the Camp system would fully justify the expenditure they had incurred, as they were looking for an increase of business in that direction, and they would naturally get the profit which the lessee used to get. After meeting all those expenses, and the fees of the local board which appeared this year at the full amount for the first time, they had a balance of £25,911 as net profit, as against £22,000 last year, an increase of about £3,000. In the special circumstances of the company the view of the board was that, although they had a somewhat larger net revenue to deal with, they had better proceed on conservative and cautious lines. They might at some future date, and he would be very glad if it was in the near future, have to incur very considerable expenditure in installing an underground system, if and whenever they should be so fortunate as to secure the requisite concession from the Government authorising them to do so. They had not yet obtained that concession, although they were always working for it. If they obtained it, it would be necessary to scrap a considerable amount of their overhead plant which had become obsolete. Under those circumstances, the board had thought it best that they should restrict their dividends to the same amount as they had paid on previous occasions. In order to deal with the possibility of having to scrap their plant in the future, they proposed to apply a considerable portion of the revenue to the depreciation fund, and that fund had this year been increased by £15,000. They had also thought it desirable to raise the reserve fund to the round figure of £60,000 by adding £1,500 to it this year. After those appropriations, they would be justified in paying 5 per cent. dividend on the preference shares, and 6 per cent. on the ordinary, as last year. Proceeding to deal with the figures in the balance sheet, the Chairman said it would be noticed that real estate in Monte Video stood at £2,600 more than it did last year. The reason was that some of their exchanges were getting overloaded with lines, and it was necessary to afford them some relief. After mature deliberation, they had decided to establish a new exchange, which he was glad to say was now practically ready for working. He could not conclude without again referring to the question of the concession they were trying to get for an underground installation. He was sorry to say that their position in that respect was very little changed from what it was last year. They were keeping their claims before the Government, but so far they had not met with the desired success. In the meantime, it might be considered that the delay that had occurred in dealing with this matter had not been free from benefit to the company. During the years that had elapsed since they started to make their application, there had been considerable development in the telephone system. The automatic system was coming very much to the front, and it might be that if they had obtained the concession earlier, they would have installed the common battery system which was now in vogue in London. He was told that the automatic system was now being tried in this country, with a considerable measure of success, and in the opinion of many telephone experts, it was the coming system. If that was so, when they obtained their concession, they would be able to install the most modern system known to the telephonic world. He must again remind them that the Government of Uruguay was still considering the question of establishing a telephone service of its own. He understood from advices received from Monte Video that His Excellency the President had recommended to the Government that they should adopt their own telephone service. No doubt before anything was done, the matter would have to be referred to the Government department there, which was similar to the British Board of Trade. Their representatives in Monte Video and the members of the local board were in constant communication with them in London on the matter, and they relied upon them to be alert to safeguard the company's interests. With regard to the propriety of the Government undertaking a business of this sort, opinions might differ, but it seemed to him that their company, with the very extensive knowledge which it had as to local requirements, and with the experienced officials and staff at its disposal, might, with far greater benefit to the community, be allowed to continue its services, improved with modern appliances and an underground system, rather than that the Government should undertake the risk involved in starting an entirely new venture. It was quite unnecessary for the Government to go to that expense, particularly as they were quite willing, in any concession which they might ask for, to give the Government any reasonable powers of expropriation on fair terms of purchase. It seemed to him that an agreement between the company and the Government based on those lines would ensure all that the Government required, and would be much more for the benefit of the community, because it would not deter the influx of foreign capital into the country which it so badly needed for its development. He hoped the Government would see the matter in its proper light, and not try to enter into competition with their company.

Mr. J. G. Le Marchant seconded the motion, and the report was adopted.

STOCKS AND SHARES.

Tuesday Evening.

The financial position, rather than the political, continues to dominate the Stock Exchange, although the House still scans the Near Eastern horizon with a good deal of nervousness, not knowing how far the war may embroil nations other than those at present engaged in it. Money for settlement purposes this week was very stiff, but plentiful enough, considering the circumstances. It is something of a relief for the Stock Exchange to be closed on the Friday in this week, though evidence of the uneasiness which abounds is displayed in the refusal of the Committee to extend the recess over the following half-day.

Home Railway stocks are moving on irregular lines. The speculation in Metropolitan Consolidated has died down to some extent, and, in consequence, the fluctuations this week in the price have been less wide than usual. Lively interest was aroused by the announcement that the Metropolitan Company has advanced a good way in its negotiations for the acquisition of the Great Northern and City Railway, the company which for years past it was assumed the Great Northern Railway would eventually take over.

The news, of course, explains the rise that has occurred in the price of the Great Northern and City shares from 1¾ to 2⅛, at which they now stand, and which is considered by authorities in the house to represent approximately the value of the shares, taking Metropolitans about 55. Some who peer into the future ask whether the move on the part of the Metropolitan may be the precursor of another that shall bring this Company into closer alliance with one of its bigger brethren, but as to this time will show. The Central London trio of stocks is steady, notwithstanding the report that the *pourparlers* said to have been passing between the Twopenny Tube and one or two of the leading steam lines are now reported to have come to an abrupt conclusion. This induced a little selling at the end of last week, but since then prices have partially recovered, and on balance the Ordinary and Deferred are both 2 lower. Districts are remarkably quiet, and City & South Londons provide an exception to the prevailing depression by advancing 1½ to 42½ middle.

Endeavours are being made to spread the impression that a powerful group is endeavouring to obtain control of the Metropolitan Electric Tramways Co., in order to link it up with the London United and to enter into an agreement with the London County Council for the joint working of the line. That some scheme or other is in the air is probable enough, but it may be just as well not

to build too freely upon the expectation of the Tramways Combine following in the footsteps of those which brought the London General Omnibus Company under the same ægis as that of the Underground Electric Railways, and which caused such a sensational rise in the price of 'bus stock. Fuller particulars will be awaited with keen interest, and they should be available shortly. Underground Electric Railways shares and income bonds, after advancing a little, went back again, so that on balance the bonds are a point down at 87, the shares being unaltered at 3¾, while the 1s. shares eased off to 12s. So far as the London United Preference are concerned, the price shows a fall of ¼. British Electric Tractions are still a weak market, the Deferred having gone back to 6, and the 7 per cent. Preferred to 38½.

There is practically nothing of fresh interest to report in the section for English Electricity Supply shares. St. James' gained 5s. on top of their previous rise of twice that amount, and Chelsea shed 2s. 6d., but apart from these there is no movement at all. Holders do not care to part with shares, in view of the prospects of the companies; and buyers are as little eager to pick up shares as in most of the other markets round the Stock Exchange. Already clients and members alike are casting their prophesies forward to Christmas; and it is urged that, with the festival less than two months away, he need be a confirmed optimist who thinks of material increase of business between now and then.

In the Telegraph market, the firmness of Marconi's deserves notice. The appointment of a Committee in the House of Commons has done a lot to quiet a certain amount of nervousness which worried the market earlier this month; and, in addition to this, another factor has been a good deal of closing on behalf of bears. Canadians, Spanish and Americans hardened up a little, in sympathy with the parent shares; and the market does not look bad, although it must be noticed that each rally brings in a few shares, and on the week there is no change. As may be supposed, sundry private-circulation prospectuses are going round the City, with details of various wireless inventions which will, according to the statements made, completely oust Marconi from the present field, but it is hardly necessary to say that the price of Marconi shares is not influenced by such competitors.

Amazon Telegraphs are better, and West India and Panama Ordinary rose ⅛ on the declaration of an interim dividend of 1s. 6d. per share. Direct Spanish Ordinary have again improved, and the Preference also rose ¼. The company seems to be doing very well, and certainly there are not many shares in the market to satisfy the steady demand. Anglo-Americans are a little lower, and the Eastern group marks time. Western Telegraphs eased off a shade, and falls of $\frac{1}{16}$ took place in Oriental Telephones and Monte Video Telephones. National Telephone Deferred is a quieter market, and on balance the quotation is 2½ down. Reuters have come into some prominence in consequence of the war, and the price keeps steady at 11¾. The Stock Exchange amuses itself with yarns of how simultaneous cables are continually arriving at the offices of the great newspaper agency giving diametrically opposite information as to the result of the various engagements.

The Latin-Canadian group has its fortitude rather severely tried by steady liquidation in certain of its stocks and shares. The news from Mexico has been much more comforting this week, and Mexico Trams recovered a point, though Mexican Light and Power fell 2. Both companies' prior charge issues have given way. Montereys are down 2. Vera Cruz fails to recover from its earlier weakness. Rio Trams and Sao Paulo Trams have been marked down 10 points each. Montreal Light, Heat and Power shed 5, and Shawinigans are 2 lower, the company's Bonds both showing declines. Anglo-Argentine Tramways 4 per cent. Debenture was pressed for sale, and a loss of 1¼ is the result; while Calcuttas dropped ⅛ upon further consideration of the report. La Plata Trams are ⅛ higher, and in some quarters are talked better, though, of course, they are a very speculative investment.

Manufacturing shares afford some indication of the manner in which investments have been realised through force of circumstances. Henleys are ¼ down, and the Preference lost $\frac{1}{16}$. India-Rubbers have gone back another 10s. On the other hand, there are rises in British Aluminium Ordinary and British Westinghouse Prior Lien stock; while Dick, Kerr Preference at ⅞ are $\frac{1}{16}$ better, the handsome yield apparently attracting purchases. The Rubber market is dull and uninteresting. Prices have a sagging tendency, and it is argued that there is nothing in the present situation to encourage buying until the price of the raw stuff exhibits signs of advance.

City Electric Light Co., Ltd., Brisbane.—The report of this company for the half-year ended July 31st, 1912, presented at the meeting held at Brisbane on September 17th, stated that after making additions to the reserve fund, dividend equalisation fund, franchise and purchase sinking fund, accident insurance fund and renewal, replacement and contingencies account, there remained a credit balance of £6,888, which, with the balance brought forward from last half-year, made £9,274 to be disposed of. The directors recommended that a dividend be paid of 3 per cent. on the preference shares, and 6¼ per cent. on the fully-paid ordinary shares, and of 6¼ per cent. on the contributing shares, the payment thereof, together with the dividend duty, absorbing £7,329, leaving a balance of £1,945 to be carried forward. Reference is made to the excellent work of the staff, which again contributed to the results obtained. "It is pleasing to note that the co-operative principle of issuing shares to its employés, which the company introduced some years ago, has been continuously satisfactory."

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Oct. 23	2,729	+ 90	21	33,454	+ 140	14·4	..
Ayr	„ 26	405	+ 17	23	9,523	+ 223	8	..
Birmingham Corp.	„ 19	21,780	+4,317	29	30·,928	+96,828	57·17	..
Blackburn	„ 23	2,447	+ 216	30⅔	36,770	+ 457	14·62	..
†Blackpool Corp.	„ 17	820	+ 146	..	59,108	+ 5,583	11·87	..
Blackpool-Fleetw'd	„ 26	722	+ 67	16	22,575	— 575	8	..
Bournemouth	„ 23	3,241	+ 45	29⅔	59,282	+ 1,771	21·95	..
Bradford	„ 19	11,791	+ 948	29	163,970	— 760	56	..
Brighton	„ 27	1,781	— 7	30	33,618	— 1,069	9·5	..
Bristol	„ 25	13,625	+1,366	..	299,521	+24,325	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	„ 18	639	+ 122	42	12,601	+ 3,326	3·65	..
Barnsley	„ 18	402	+ 15	„	7,542	— 245	..	..
Barrow	„ 18	697	+ 78	„	16,200	+ 3,118	5·27	..
Devonport	„ 18	1,079	+ 58	„	22,678	+ 1,601	8·85	..
Gateshead	„ 18	2,221	+ 84	„	43,812	+ 9	11·25	..
Gravesend	„ 18	445	+ 25	„	8,883	— 176	6·5	..
Greenock	„ 18	1,631	+ 184	„	34,280	+ 3,549	7·25	..
Kidderminster	„ 18	209	+ 17	„	5,124	+ 75	..	..
†Leamington	„ 18	28	+ 25	„	1,209	+ 475	..	..
Merthyr	„ 18	451	— 4	„	8,473	— 882	2·9	..
Metropolitan	„ 18	16,328	— 551	„	370,192	— 1,288	22	..
Middleton	„ 18	679	+ 37	„	14,201	— 348	8·5	..
Mid. Joint Com'tee	„ 18	6,798	+ 670	„	128,770	+ 6,964	..	..
Oldham—Ashton	„ 18	1,267	+ 62	„	25,767	+ 1,527	9·18	..
Peterborough	„ 18	263	+ 18	„	5,837	+ 336	5·31	..
Potteries	„ 18	4,219	— 33	„	80,164	— 1,523	29	..
Rothesay	„ 18	134	+ 16	„	10,254	+ 453	2·75	..
Southport	„ 18	557	+ 12	„	12,284	— 266	8·17	..
S. Metropolitan	„ 18	1,678	+ 60	„	35,986	— 958	..	..
Swansea	„ 18	2,341	+ 88	„	48,596	+ 205	12·5	..
Tynemouth	„ 18	985	+ 35	„	10,729	— 936	3·75	..
Weston-s-Mare	„ 18	127	+ 1	„	6,660	— 1,297	3	..
‡Worcester	„ 18	567	+ 19	„	12,577	— 78	5·75	..
Wrexham	„ 18	245	+ 31	„	4,865	+ 558	..	..
Yorks. Wool. Dist.	„ 18	2,260	+ 87	„	45,586	+ 1,123	17	..
Miscellaneous	„ 18	445	+ 28	„	9,887	+ 173	..	..
Burnley	„ 26	2,989	+ 278	..	..	..	12·44	·7
Burton-on-Trent	„ 27	557	— 24	30	8,277	— 470	6·6	..
Bury	„ 27	2,488	+ 65	30	39,691	— 356	22·5	..
Cardiff	„ 26	4,733	+ 191	30	74,053	— 1,976	17·35	..
Chatham and Dist.	„ 24	1,731	+ 122	43	37,072	— 48	14·98	..
Cork	„ 24	921	— 48	43	20,833	— 949	9·89	..
Croydon	„ 18	3,540	— 141	39	58,473	— 994	11·6	..
†Darlington	„ 19	229	+ 112	29	6,557	+ 62	4·87	..
Darwen	„ 25	565	+ 36	30	8,461	+ 220	4·36	..
Dover	„ 19	464	+ 4	29	7,696	— 562	4·75	..
Dublin	„ 25	11,015	+ 163	..	100,611	— 8,813	54·25	..
East Ham	„ 26	2,108	+ 14	30	32,381	— 880	7·87	..
Exeter	.. ..	..	..	..	..	..	..	..
Glasgow	„ 26	38,431	—1,480	..	367,470	— 9,611	98	..
Hastings	„ 24	1,7.6	+ 49	..	..	..	19·3	..
Hull	„ 26	6,641	+ 219	30	88,329	+ 933	13·5	—1
Ilkeston	„ 25	276	— 12	30	3,386	— 699	..	..
Ipswich	„ 26	760	— 3	30	14,173	— 221	10·5	..
Kilmarnock	„ 26	328	+ 18	23	3,927	— 173	4·25	..
Lancashire United	„ 23	2,782	+ 151	43	58,123	— 18	39	..
Leeds	„ 26	15,329	+ 405	30	235,648	+ 7,423	112·7	..
Leicester	„ 26	5,243	+ 94	43	109,792	+ 3,340	20	..
Leith	„ 26	1,244	+ 61	239	16,554	+ 352	8·724	..
Liverpool	„ 19	24,203	+ 965	41⅔	502,319	+21,476	119	3
†L.C.C.	„ 16	81,321	—5,370	..	1,206,657	—70,465	141·1	—·5
London United	„ 26	11,412	+ 13	..	271,623	—13,463	..	..
Lowestoft	„ 26	363	— 6	3	693	— 10	3·5	..
Manchester	„ 26	33,232	+ 772	30	506,276	+16,995	105	..
Newcastle	„ 26	9,305	+ 278	..	132,295	— 2,229	31·3	..
†Newport	„ 17	697	+ 50	28	19,913	— 558	7·25	..
Oldham	„ 27	4 125	— 29	31	64,373	+ 3,527	23	..
Pontypridd	„ 26	851	+ 25	30	11,906	— 6.9	5·5	..
Portsmouth	.. ..	..	..	..	..	..	15·75	..
Preston	„ 23	1,594	+ 88	30	25,181	+ 1,119	10	..
Rotherham	„ 23	1,814	+ 442	29⅔	22,185	+ 1,901	18	6
Salford	„ 28	9 644	+ 184	30½	152,632	+ 3,312	41	..
Sheffield	„ 27	13,802	+ 863	..	206,362	+ 8,146	40	..
Southampton	„ 23	2 274	— 50	29	38,267	— 106	11	..
Southend-on-Sea	„ 23	1,232	+ 186	30	26,233	+ 2,662	7	..
South Shields	„ 26	1,258	+ 97	30	19,436	+ 136	10·25	..
Tyneside	„ 23	1,119	+ 84	17	8,532	— 689	11	..
Wallasey	„ 22	1,994	+ 10	299	34,441	— 455	8·72	..
Walthamstow	„ 26	1,320	+ 3	30	22,833	— 884	9	..
West Ham	„ 17	4 937	— 375	28⅔	76.057	— 2,985	15·45	1·2
Wolverhampton	„ 23	2,100	+ 175	30	30,647	+ 631	13·75	..
Cen. London Rly.	„ 26	10,979	+ 836	17	79,207	+ 2,037	6·78	·4
City & S. Lon. Rly.	„ 27	6,162	— 465	17	49.226	— 3,776	7·26	..
Dublin-Lucan Rly.	„ 25	247	+ 11	17	2.681	— 110	7	..
G.N. and City Rly.	„ 26	3,038	— 45	17	23,408	— 96	3·5	..
L'pool Overh'd Rly.	„ 27	5,136	+ 298	..	28,215	+ 2,245	6·6	..
Llandudno-Col. Bay	„ 25	385	+ 70	47·5	15,438	+ 725	6·5	..
Lond. Elec. Ry. Co.	„ 26	28,385	+ 465	..	214,460	+ 6,160	21·25	..
Mersey Railway	„ 26	4 825	+ 443	17	35.651	+ 3,775	4·5	..
Metropolitan Rly.	„ 27	84,421	+ 397	17	285.827	+ 6,263	35·75	..
Met. District Rly.	„ 26	26,838	+2,170	..	2 7.448	+18 299	25	..
Anglo-Argentine	„ 21	108,240	+9,212	..	2,140 264	+90,112	..	..
§Auckland	Sept. 27	18.498	+ 2 593	..	68 938	+10,586	24·1	..
Bombay (B.E.T.)	Oct. 4	6 335	+ 100	39	119.722	+ 5.806	..	..
§Brisbane	Sept.	22,700	+1,660	9	181,094	— 3,566	..	..
Brit. Columbia Rly.	.. ..	..	..	..	..	..	..	..
Calcutta	Oct. 16	8,517	+ 56	..	..	+13,278	..	..
Cape Electric T. Ltd.	.. ..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Sept.	3,251	..	9	28,788	..	20·5	..
§Lisbon	.. ..	..	..	..	..	..	..	..
Madras	Oct. 15	1,692	+ 202	..	31 634	+ 3,500	14·7	2
§Montevideo	Sept.	27,711	+4,465	11	317,818	+44,299	..	..
Perth (W.A.)	Oct. 25	4 006	+ 591	..	80,229	+11,401	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Oct. 29th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5†	9⅛ — 10⅜	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8½ — 9⅜	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord...	5	10	9†	9 — 9½	..	5 5 3
Do. 7 % Cum. Pref.	5	7	7	8½ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb... ..	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4⅜ — 4⅞	— ⅛	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12½ — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 —102	..	4 8 3
County of London, Ord... ..	10	6	4†	11¼ — 11⅝	..	5 2 2
Do. 6 % Pref.	10	6	6	11⅝ — 12¼	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	..	7/16 — 11/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7⅞ — 7⅞ xd	..	5 14 3

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Oct. 29th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2½	..	1⅝ — 2½	..	3 10 8
Do. 6 % Pref.	5	6	6	4½ — 5½	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3⅜ — 4⅛	..	4 17 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98½ —101½ xd	..	4 18
Notting Hill, 6 % Non-Cum. Pref.	10	8	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	9½ — 10½	+ ½	4 17 7
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88	..	3 19 7
Smithfield Markets, Ord. ..	5	2	..	1⅜ — 1⅞	..	.. 3
South London, Ord.	4	5	..	3 — 3½	..	5 14 0
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1⅛ — 1¼	..	5 12 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord...	£3	Nil	..	1/16 — 3/16	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅜ — 3⅛	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84½ — 86½	..	5 1 8
Westminster, Ord.	5	10	9†	8⅞ — 9¼	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8½	..	7 — 7⅛	— ⅛	5 13 4
Do. 5 % Pref.	5	5	5	4⅛ — 5⅞	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½	—1	5 5 9
Canadian Gen. El. Com. ..	$100	7	7	115 — 119	—1	5 17 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	..	⅞ — 1	..	3 0 0
Do. 5 % Deb.	100	5	5	£4 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	£3 — £6	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Pref.	1	6	6	1/16 — 1/8 xd	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86 — 88	..	5 18 8
Mexican Lt. & Power, Common	$100	4	4†	83 — 86 xd	—2	4 13 0
Do. 7 % Cum. Pref.	$100	7	7	102 —105 xd	—1	6 13 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	93½ — 95½	..	5 4 9

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	£3 — 86	—2	5 16 3
Montreal, Lt., H. and Power ..	$100	8	9†	233 —238	—5	3 7 3
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	39 — 42	..	..
River Plate, Ord.	Stock	10	..	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital ..	$100	5	5	141 —145 xd	—2	3 9 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	—1	4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½—104½	— ½	4 6 2
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	96½— 98½xd	..	4 11 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 4 2
Victoria Falls Power, Pref. ..	1	11¾d.	17¾d.	1/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	..	7⅞ — 8⅛	+ ¼	4 18 6
Do. 5 % Deb. Red.	Stock	5	5	96 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	145½—147½	..	5 8 6
Do. Collat. Trust	$1000	4	4	93½ — 95½	..	4 3 9
Anglo-American Telegraph ..	Stock	8	8	67 — 69 xd	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110¾—111¾xd	— ⅛	5 7 7
Do. Def.	Do.	30/-	..	25⅝ — 25⅞	— ⅛	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7⅞ — 7⅞	..	4 8 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81 — 83	—1	4 16 8
Cuba Telegraph	10	6	..	9½ — 10⅜	..	5 14 3
Do. 10 % Pref.	10	10	10	16½ — 17⅜	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¾ — 4	+ ¼	5 0 0
Do. 10 % Cum. Pref.	5	10	10	6¾ — 7¼	+ ¼	6 18 0
Direct United States Cable ..	10	5	4	7¼ — 7⅝	..	6 9 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	129 —132 xd	..	5 6 1
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	77 — 79 xd	..	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	99¼—101½	..	3 18 10
Eastern Extension	10	7	7†	12⅜ — 13⅛ xd	..	5 5 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	10⅜ — 11½	..	5 7 7
Do. 6 % Pref.	10	6	6	12⅜ — 13½	..	4 10 7
Great Northern Telegraph ..	10	18	18	28 — 29	..	6 4 2
Indo-European Telegraph ..	25	13	..	57½ — 59½	..	5 9 3
Mackay Companies Common ..	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	..	5 — 5⅛	..	3 18 2
Do. 7 % Cum. Partic. Pref.	1	17	..	4⅜ — 4⅝	..	3 14 0

Monte Video Telephone, Ord...	1	6	..	1 — 1⅛	— 1/16	5 13 0
Do. 5 % Pref.	1	5	5	1⅛ — 1⅛	..	5 6 8
National Telephone Def. ..	Stock	6	..	154 —156	—2½	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100 —101	..	4 9 1
Oriental Telep. and Elec. ..	1	8	..	1 11/16 — 1 13/16	— 1/16	4 8 2
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	10⅞ — 11⅜xd	..	8 16 2
Submarine Cables Trust ..	Cert.	6	6	126 —129 xd	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	..	7⅞ — 7⅞	..	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 13/16 — 1 15/16	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	..	3½ — 3⅝	+ ⅛	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10⅝ — 11⅝	..	5 7 10
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¾ — 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	13½ — 13⅝	— ⅛	5 1 10
Do. 4 % Deb.	Stock	4	4	96½ — 98½	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98½—101½ xd	..	4 8 8

* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Oct. 29th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil		..	Nil
Do. 5 % Pref.	1	5	5		..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref.	100	..	..	11½ — 13½	..	..
Do. Do. Deferred	100	..	..	5 — 7	—1	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	37 — 40	—1	..
Do. 5 % Perp. Deb.	100	5	5	90 — 94	..	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 88	..	5 7 2
Central London Railway, Ord.	100	8	8†	72 — 74	—2	4 1 1
Do. Pref.	100	4	4	83 — 85	..	4 14 2
Do. Def.	100	2	..	71 — 73	—2	2 14 10
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	100	1⅝	1½	42 — 43	+1½	3 4 0
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	105 —107	..	4 13 6
Do. Do. 1901	100	5	5	105 —107	..	4 13 6
Do. Do. 1908	100	5	5	104 —106	..	4 14 4
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2½ — 2⅝	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	1⅝ — 2⅛ xd	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼ — 2⅜	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5⅛ — 5⅝	— ¼	..
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 3
Metropolitan Railway Consol.	100	1¾	1½†	52¾ — 53¼	—1	3 1 0
Do. Surplus Lands	100	2½	2½†	63 — 65	—1	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	84 — 86	+1	4 1 5
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	Nil	38½ — 38⅝	+ ½	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	4½	4½	88 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅜ — 1⅝ xd	..	4 16 0
Do. Def.	1	Nil	..	31/32 — 1	— 1/32	Nil
Do. 5 % Pref.	1	5	5	31/32 — 1	— 1/32	5 10 6
Do. 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9
Do. 5 % Deb.	100	5	5	96 — 99	—1½	5 1 0
Potteries, Ord.	1	3½	..	15/16 — 1 7/32	..	..
Do. 5 % Pref.	1	5	5	1 7/32 — 1 9/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	1⅛ — 1⅜	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	3⅞ — 4	..	Nil
Do. "A"	1/-	..	..	3/16 — 3/8	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	86 — 88	—1	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/4 — 3/8	..	Nil
Do. 6 % Pref.	5	3	..	2¾ — 3⅛	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	£⅓	4⅞ — 5⅛	..	5 7 4
Do. 2nd Pref.	5	5½	£⅓	4 11/16 — 5 1/16	..	5 3 6
Do. 4 % Deb.	100	4	4	91½ — 93½	—1½	4 5 7
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	99 —101	..	4 19 0
Auckland Trams, 5 % Deb.	100	5	5	103½ —105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11¾ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8	..	7¼ — 7⅝	..	5 3 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	100½ —103⅜	..	4 7 0
B. Columbia Elec. Rly., Def.	100	8	..	142 —147	..	5 8 10
Do. Pref. Ord.	100	6	6	115½ —119½	+ ½	5 0 6
Do. 5 % Pref.	100	5	5	104½ —107½	..	4 18 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101 xd	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	101 —103	..	4 2 6
Calcutta Trams, Ord.	5	7	5†	6 — 6⅛ xd	..	5 7 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 8
Cape Electric Trams	1	2½	..	1 7/16 — 1 9/16	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 1/16 — 5 3/16	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	1/16 — 3/16	+ 1/16	..
Do. Pref.	1	6	..	3/16 — 1/4	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	..	1 1/16 — 1 1/16	..	4 11 5
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	91 — 94	—1	5 6 6
Manila Elec. R. and Ltg., Bonds	£1000	5	5	100½ —102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	113 —117 xd	+1	5 19 8
Do. Gen. Con. 5 % Bonds	..	5	5	92½ — 94½	—2½	5 5 10
Do. 6 % Bonds	100	6	6	96½ — 99½	—2	6 0 7
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7 5/16 — 7 7/16	..	6 12 5
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —101	—1½	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5†	1⅛ — 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅞	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	5	5†	145 —155	—10	3 4 6
Do. 1st Mort. 5 % Bonds	..	5	5	100½ —102½	..	4 17 7
Do. 5 % Mort. Bonds	100	5	5	95½ — 97½	..	5 2 7
Sao Paulo Tram, Lt. and P.	$100	10	10†	255 —265	—10	3 15 6
Do. 5 % 1st Deb.	£500	5	5	102 —104	..	4 14 4
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	..	5⅜ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	3/16 — 3/8	..	8 0 0
Do. 6 % Pref.	1	6	6	1 1/16 — 1 3/16	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3⅛ xd	— 1/16	4 6 2
Do. Pref.	1	6	6	1 7/16 — 1 9/16 xd	..	3 16 10
British Aluminium, Ord.	1	Nil	..	1 3/16 — 1 5/16	+ 1/16	..
Do. 6 % Cum. Pref.	1	Nil	..	1/8 — 3/16	..	..
Do. 5 % Prior Lien Debs.	100	5	5	92 — 95	— 1	5 5 2
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7⅛ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅝ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref.	3	Nil	Nil	1/2 — 3/4	..	Nil
Do. Deb.	100	4	4	60 — 63	..	6 7 0
Do. 6 % Prior Lien	100	6	6	100 —103	+1	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — 1/4	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb.	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	..	10½ — 11	..	6 16 4
Do. Pref.	5	5	5	4½ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
Castner-Kellner	1	20	15†	31 1/16 — 31 3/16	..	5 4 9
Do. Deb.	100	4½	4½	105 —108	..	4 3 4
Crompton & Co.	3	Nil	..	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	1/16 — 1/8	..	..
Do. Pref.	1	6	6	1 3/16 — 1 5/16 xd	+ 1/16	6 8 0
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	1/4 — 3/8	..	Nil
Do. fully paid	5	Nil	..	1 1/4 — 2	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb.	100	5	5	72 — 75	..	6 18 4
Electric Construction	2	2⅜	3⅜	3/4 — 1	..	7 10 0
Do. Pref.	2	7	7	1 3/4 — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 6 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb.	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12 — 12¾	— 1/4	6 13 4
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	— 1/16	4 9 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	10⅛ — 11⅛	— ⅛	..
Do. Pref.	10	5	5	9⅝ — 10⅝	..	4 17 7
Telegraph Construction	12	17½	5†	34 — 36	..	6 13 4
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	1/8 — 1/4	..	Nil
Do. Pref.	5	Nil	..	1/2 — 1	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

TRADE STATISTICS OF SWEDEN.

The following figures show the imports of electrical and similar goods into Sweden during the year 1910, and are taken from the official statistics which have recently been issued; the figures for 1909 are given for purposes of comparison, and notes of any increases or decreases have been added.

	1909. Kronor.	1910. Kronor.	Increase or decrease. Kronor.
Electric meters.—			
From Germany	402,000	611,000	+ 209,000
„ Great Britain ...	30,000	71,000	+ 41,000
„ Other countries ...	3,000	2,000	— 1,000
Total ...	435,000	684,000	+ 249,000
Electric incandescent lamps.—			
From Germany	402,000	642,000	+ 240,000
„ Great Britain ...	—	1,000	+ 1,000
„ Switzerland ...	—	7,000	+ 7,000
„ Austria-Hungary ...	—	29,000	+ 29,000
„ Holland	—	7,000	+ 7,000
„ Other countries ...	12,000	9,000	— 3,000
Total ...	414,000	695,000	+ 281,000
Dynamos and parts thereof.—			
From Germany	132,000	184,000	+ 52,000
„ Great Britain ...	1,000	4,000	+ 3,000
„ Switzerland ...	127,000	81,000	— 46,000
„ France	—	12,000	+ 12,000
„ Austria	16,000	—	— 16,000
„ Other countries ...	17,000	7,000	— 10,000
Total ...	293,000	288,000	— 5,000
Electric motors and parts thereof.—			
From Germany	378,000	447,000	+ 69,000
„ Great Britain ...	19,000	7,000	— 12,000
„ Switzerland ...	127,000	12,000	— 115,000
„ United States ...	15,000	22,000	+ 7,000
„ Other countries ...	14,000	28,000	+ 14,000
Total ...	553,000	516,000	— 37,000
Transformers and parts thereof.—			
From Germany	238,000	235,000	— 3,000
„ Great Britain ...	1,000	2,000	+ 1,000
„ Switzerland ...	—	22,000	+ 22,000
„ Austria	115,000	—	— 115,000
„ Other countries ...	3,000	1,000	— 2,000
Total ...	357,000	260,000	— 97,000
Telephone apparatus.—			
From Germany	12,000	6,000	— 6,000
„ Great Britain ...	1,000	1,000	—
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	14,000	9,000	— 5,000
Telegraph apparatus.—			
From Denmark	5,000	3,000	— 2,000
„ Germany	1,000	2,000	+ 1,000
„ Great Britain ...	1,000	2,000	+ 1,000
Total ...	7,000	7,000	—
Gas motors.—			
From Germany	102,000	28,000	— 74,000
„ Great Britain ...	23,000	33,000	+ 10,000
„ United States ...	41,000	8,000	— 33,000
„ Other countries ...	3,000	2,000	— 1,000
Total ...	169,000	71,000	— 98,000
Petroleum and benzine motors.—			
From Germany	63,000	56,000	— 7,000
„ Denmark	26,000	50,000	+ 24,000
„ Great Britain ...	7,000	17,000	+ 10,000
„ France	10,000	17,000	+ 7,000
„ United States ...	74,000	162,000	+ 88,000
„ Other countries ...	23,000	28,000	+ 5,000
Total ...	203,000	330,000	+ 127,000
Turbines.—			
From Norway	111,000	17,000	— 94,000
„ Germany	3,000	1,000	— 2,000
„ Great Britain ...	—	3,000	+ 3,000
Total ...	114,000	21,000	— 93,000
Accumulators.—			
From Germany	477,000	497,000	+ 20,000
„ Great Britain ...	7,000	6,000	— 1,000
„ Other countries ...	2,000	1,000	— 1,000
Total ...	486,000	504,000	+ 18,000

	1909. Kronor.	1910. Kronor.	Increase or decrease. Kronor.
Rheostats.—			
From Germany	689,000	689,000	—
„ Great Britain ...	10,000	19,000	+ 9,000
„ Switzerland ...	42,000	69,000	+ 27,000
„ Other countries ...	15,000	16,000	+ 1,000
Total ...	756,000	793,000	+ 37,000
Elevators.—			
From Germany	81,000	44,000	— 37,000
„ Holland	99,000	—	— 99,000
„ Great Britain ...	4,000	5,000	+ 1,000
„ Other countries ...	14,000	2,000	— 12,000
Total ...	198,000	51,000	— 147,000
Cranes.—			
From Germany	134,000	38,000	— 96,000
„ Great Britain ...	56,000	85,000	+ 29,000
„ United States ...	10,000	91,000	+ 81,000
„ Other countries ...	25,000	25,000	—
Total ...	225,000	239,000	+ 14,000
Copper wire, twisted, and cable not insulated.—			
From Germany	117,000	137,000	+ 20,000
Copper wire covered with textiles.—			
From Germany	6,000	7,000	+ 1,000
„ Other countries ...	1,000	1,000	—
Total ...	7,000	8,000	+ 1,000
Copper wire covered with rubber.—			
From Germany	5,000	2,000	— 3,000
„ Other countries ...	1,000	1,000	—
Total ...	6,000	3,000	— 3,000
Electric cables covered with lead.—			
From Germany	2,767,000	3,078,000	+ 311,000
„ Holland	43,000	63,000	+ 20,000
„ Great Britain ...	251,000	281,000	+ 30,000
„ Other countries ...	7,000	2,000	— 5,000
Total ...	3,068,000	3,424,000	+ 356,000
Copper wire otherwise insulated.—			
From Germany	252,000	279,000	+ 27,000
„ Great Britain ...	15,000	21,000	+ 6,000
„ Other countries ...	1,000	9,000	+ 8,000
Total ...	268,000	309,000	+ 41,000
Other electric cable.—			
From Germany	226,000	326,000	+ 100,000
„ Great Britain ...	3,000	10,000	+ 7,000
„ Other countries ...	2,000	1,000	— 1,000
Total ...	231,000	337,000	+ 106,000
Steam turbines.—			
From Germany	64,000	114,000	+ 50,000
„ Great Britain ...	7,000	18,000	+ 11,000
„ Switzerland ...	319,000	29,000	— 290,000
„ Other countries ...	3,000	—	— 3,000
Total ...	393,000	161,000	— 232,000
Steam boilers.—			
From Germany	115,000	36,000	— 79,000
„ Great Britain ...	75,000	230,000	+ 155,000
„ Other countries ...	19,000	7,000	— 12,000
Total ...	209,000	273,000	+ 64,000

Krone = 1s. 1½d.

Wire Lamp Patents in Germany.—It will, perhaps, be remembered that a year or two ago the three largest makers of wire lamps in Germany (Siemens & Halske Co., the A.E.G. and the Auer Gasgluhlicht-Gesellschaft) entered into a community of interests in regard to patents for the construction of drawn-wire lamps, in the sense of an interchange of patents and processes. It is now reported that the Bergmann Electricity Works Co., which is engaged on a new process, is in negotiation with the three firms in question with a view to being included in the community so as also to be able to produce drawn-wire lamps, without the risk of patent proceedings.

RECENT DEVELOPMENTS IN WIRELESS TELEGRAPHY: WITH SPECIAL REFERENCE TO SHIP INSTALLATIONS.

(*Concluded from page* 680.)

Receiving and Transmitting Circuits.

Source of Primary Energy.—According to the class of station concerned, from ¼ to 10 KW. of energy must be provided in the primary circuit of a ship installation (see above). Stations requiring from 250-500 watts input may conveniently be operated from the ship's supply network (24-220 volts) by the use of a resonance inductor and a high-speed trembler contact feeding the closed oscillation circuit of the spark sender. The sending key controls the primary current, and a variable resistance provides for the control of the inductor train and the wave "tone." In large stations a D.C. shunt motor, capable of wide speed variation, is driven from the ship mains and direct coupled to a suitable alternator. Whenever traffic is brisk the converter set should be kept running continuously, and, in any case, it is best located in a weatherproof chamber outside the main operating room.

Sender.—The frequency of the oscillating current in the aerial is about 1,000,000 cycles per second, and, as energy cannot be delivered at such a frequency from a dynamo-electric generator, a method of working is employed which is admirably exemplified by the high-frequency "natural" vibrations persisting in a bell gong after the latter has received one of a series of low-frequency blows from a vibrating hammer. Alternating current from a 200-volt 1,000-cycle machine, say, is transformed to from 8,000 to 20,000 volts, which pressure is supplied to a condenser in the "exciting" circuit. Once per cycle of the charging current the condenser discharges across a spark gap and the energy then oscillating in the primary circuit is rapidly transferred by "coupled" inductance coils to the aerial circuit. This transference corresponds to the "hammer-blow" in the above analogy, and the aerial energy now oscillates at the natural frequency of the aerial for some time after the primary oscillation has ceased; during this period the secondary oscillation is undamped by any reaction from the primary.

Receiver.—It is unnecessary to dilate upon the principles of reception. With uniform radiation in every direction from the sending station (and directive transmission is yet in embryo) the energy in the receiving aerial may be less than $1/10^7$ that radiated from the sending station, and in shipwork the inevitable limitation of the aerial dimensions makes the conditions yet more arduous, so

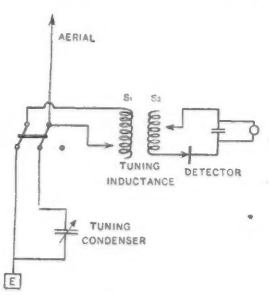


Fig. 16.

that the best possible tuning circuit and detector should alone be employed. The conditions of ordinary marine working make simplicity and strength imperative, so that a compromise is necessary. Fig. 16 illustrates a very useful and simple form of receiving circuit, which has been greatly adopted in the German mercantile marine.

The old slow-spark system of working used a "coherer" *detector* (depending for its operation on a breakdown voltage between its terminals), controlling a Morse printer through a relay circuit. Now, however, "quantitative" or "current" detectors are almost exclusively employed. The Schlömilch electrolytic detector has been, and is still, widely used, but detectors of the "contact" class* will probably be chiefly used for marine work in future. These detectors are extraordinarily sensitive, but they are not suitable for working a Morse printer, and it becomes necessary to receive messages by aid of a telephone, which must therefore be kept to the operator's ear during the whole of his working shift. This is obviously a great objection on cargo steamers or other vessels to which few messages are likely to be addressed, and it seems probable that various call-relays, suitable for use in conjunction with contact-detectors, will soon be perfected. The Telefunken call apparatus comprises a sensitive galvanometer connected in place of the telephone receiver, and ringing a call bell by a relay circuit if any predetermined wave length acts on the aerial for 10 seconds. The latter condition guards against false alarms due to "atmospherics," and a cardan suspension prevents false alarms due to ship movements, but no device yet devised will discriminate between those signals at a given wave length which are, and are not, intended for the vessel; so that, in such frequented waters as the Channel, the satisfactory use of such a call apparatus would be impossible. A more practical solution of the problem seems to be the arrangement of definite hours of continuous attendance on all vessels unable to support a day and night service for the reception of signals.

Complete Installation.—The leading particulars of the standard radio-equipment designed by the Telefunken Co. for use on large mercantile vessels are as follows:—Primary input, 3-4 KW.; guaranteed antenna radiation, 1·5 KW. Guaranteed range of transmission, with average ship aerial, 650 km. by day, and 1,200 km. by night. Space occupied by equipment 2 × 2 × 2 metres; weight of transformers, 600 kg.; weight of remainder of equipment 300 kg. Generator frequency (variable over a wide range, to permit tone adjustment), 500 cycles per second normal; H.T. delivery from transformers, 8,000 volts; transmitting wave length, 300-900 m.*; receiving wave length, 200-2,500 m. normally, 4,000 or 6,000 m. arranged for if desired.† The energy radiated is regulated by using one or more of the eight spark-gaps provided, and a hot-wire ammeter is installed to check the working of the installation before commencing message work.

Auxiliary emergency stations and aerials (see fig. 11) should be installed on every vessel so as to make the radio-telegraphic communication of the latter, at least for a little while, independent of any power supply from rotating machinery. As noted above, an accumulator battery and high-speed trembler contact form the essential features of such a station which, with an input of 500 watts, and using a small auxiliary aerial will transmit 200 km. by day and 400 km. by night. It is desirable that the auxiliary should be entirely independent of the main equipment.

General Working Conditions; Legislation; Interchange of Messages.

The extensive adoption of radio-telegraphy in the German mercantile marine began considerably later‡ than in the British and American fleets, mainly for the reason that, up to 1907, German vessels had very restricted facilities for intercommunication with coastal stations. Prior to the Berlin Congress, Marconi land and ship stations refused to communicate with stations equipped with "foreign" systems.§ The folly, if not the actual danger, of such a monopolistic policy, was formally recognised, and provisions made for compulsory intercommunication between stations working on *all* systems, by the International Conference of 1907, when all the important States, excluding Italy and the U.S.A.‖ agreed that (1) A sufficient number of "public" coast stations should be erected in their respective territories to meet the needs of shipping, and that, irrespective of the nationality of the ships and land stations and of the radio-system employed, inter-communication be compulsory, when possible. (2) All except England, U.S.A. and Italy, agreed that such inter-communication should also be compulsory upon ships.

The recently-constituted Betriebsgesell fur drahtlose Telegraphie should do much to combine the interests of various radio-systems in Germany, and it further proposes to undertake the important duty of supplying telegraphists to passenger steamers, and then accepting entire responsibility for technical efficiency and the fulfilment of official regulations. On cargo steamers, no such special staff can be afforded, but the great simplifications and improvements in the design of working parts during the last few years make satisfactory operation by any person who has received a short period of training quite possible.

Courses of instruction in radio-telegraphy have been arranged in the Hamburg, Bremen and Elsfleth Schools of Navigation, and during the last 18 months, 42 ships' officers have passed the official examination in this subject. A special department has lately been inaugurated at the Ecole Superieure d'Electricité for practical and theoretical instruction and research in wireless telegraphy and

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* These are composed of various "couples" of different metals, or of various metals (one at a time) in contact with various crystalline minerals. The action of the detectors appears to be partly thermo-electric and partly rectifying. See also Electrical Review, Vol. LXVIII, pages 11 and 72.

* Raised to 1,600 m. by the use of auxiliary inductance; usually mercantile vessels work only on the international wave lengths for this class, viz., 300, 450 or 600 m.

† It is common for a ship to send to a land station at 600 m. wave length and to receive at 2,000 m. from the latter.

‡ Two years ago, 58 ships were equipped: now more than 160 are fitted.

§ The large Hamburg-American and Norddeutscher Lloyd lines could not afford to neglect the use of radiography, and therefore respectively contracted to use none but the Marconi system till 1914 and 1917.

‖ Italy recognised the desirability of the regulations proposed, but was herself bound by contracts with the Marconi Co.; the U.S.A. was something of a turncoat in the matter. The result of her (enforced) abstention from the international agreement has been that Italy has lost the bulk of the wireless traffic which should have fallen to her coast stations, to the French Mediterranean stations and the powerful Austrian station on the Adriatic. The U.S.A. stations are not bound to accept all messages, but the State stations do so, so far as their other obligations permit. The large number of private stations which have been erected to work various systems makes the position of the Marconi Co., as regards monopoly, weak. The American law of July 1st, 1911, stipulating that all vessels, of whatever nationality, coming under specified classes and sailing to and from American ports, shall be equipped with radio-telegraph apparatus and shall exchange wireless messages with *any* other ship—not only enforces a rapid development of wireless telegraphy in the American mercantile marine, but also deals a severe indirect blow at the Marconi monopoly.

telephony,* and it is to be hoped that, in a matter of such importance, other authorities will take steps to provide further training facilities.†

Wireless Telegraphy and Navigation and Coastguard Duties.

Radio-telegraphy has already firmly established itself as an aid to navigation. In addition to the Eiffel Tower signals,‡ there are now despatched mean-European time signals from the Norddeich station (at 1 a.m. and 1 p.m.), under the control of the Wilhelmshaven Observatory. The code arranged is very similar to

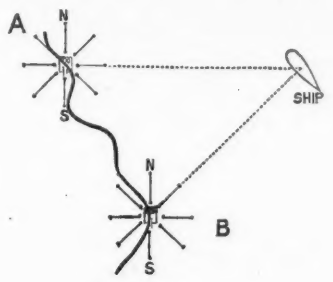

Fig. 17.

that adopted by the Eiffel Tower, and comprises a train of warning signals followed by a set of time signals, the last of which ends at 1 o'clock precisely. Weather and storm reports, averaging about 25 words in length, conclude this invaluable service. The cost of the necessary installation is no greater than that of a medium quality chronometer, and is particularly justified in the case of small vessels plying in the areas served by the land stations.§

The commercial value of maintaining continuous (or nightly) communication between land stations and ships bound on long voyages can hardly be over-estimated, and it is interesting to note that wireless telegraphy has already proved of great value in preventing port contagion from infected ships, and in generally expediting the work of port sanitary officers.

The use of radio-telegraphy as a supplement to, or even as a substitute for, lighthouses, is now widely recognised, and most of the important lighthouses are now provided with wireless apparatus. In fog and storm, the light-beam is more or less invisible, but wireless warnings can still be emitted, and it is possible for a ship to take its bearings accurately by receiving signals from two coast stations, the exact position of which is charted. The principle of a system which has been evolved in Germany, is illustrated in fig. 17. A number of coast stations are each provided with 16 or 32 aerials, directed towards the points of the compass. At each station, the sender is automatically connected in sequence with each aerial, and thus emits a continuous train of signals according to a code which is predetermined for each station. The operator on board a ship off the coast notes down the signals from the two stations nearest-by, and ascertains which signal is the strongest in each group. This will be from the aerial directed towards the ship, and a certain degree of interpolation being possible between the aerials, the position of the vessel can be accurately determined from the chart showing the stations and coast concerned. This system needs no special receiver or aerial on the ship, but it certainly appears that the Bellini-Tosi radio-goniometer* is, on the whole, a much more practical, economical and satisfactory arrangement.

Statistics are steadily being collected as to the effect of various atmospheric conditions on the quantitative results of wireless working, and it may ultimately be possible to prophesy, with some degree of certitude, the interdependance between the working of a given station and meteorological conditions. At present we can do little more than generalise in this matter.†

* The maximum number of pupils is at present limited to 20, who are very carefully selected by merit. In addition to a comprehensive scheme of practical work, lectures are delivered on theoretical and practical radio-telegraphy, on international and local regulations, on electrical units and electrical and mechanical testing (as applied to radio-telegraphy), and on meteorology and electrical discharges in gases. A number of the studentships are reserved for military and naval officers at a fee of £24; the ordinary fee for the course is £30, or £12 for permission to attend all the lectures. The training is spread over a period of three months.

† While facilities are so limited and so costly, these special courses can never be attended by the rank and file of wireless operators, and the latter have to acquire their knowledge of the special conditions of wireless work by devious and more or less unsatisfactory means. Even a carefully-planned course of continuous instruction in radio-telegraphy must occupy three or four months, and an operator can hardly be allowed to take charge of a station till he can receive and transmit 78-80 letters per minute.

‡ See also Electrical Review, "Wireless in Horology."

§ Large ships, already equipped with powerful wireless equipments can take advantage of the above service as a matter of course. The value of the time, and especially of the storm signals, is, however, relatively greatest in the case of small coasting and fishing vessels, and the equipment of the latter at least with receiving apparatus, forms a most interesting and important problem. A certain large Dutch and German fishing company has recently equipped a number of steam trawlers in its employ with simple radio-telegraph installations for transmitting instructions regarding the distribution of shoals, from vessel to vessel, and for the reception of storm signals, instructions regarding return to market and so on, from land stations. One member, at least, in each crew is instructed in the use of the apparatus, and a simple code is adopted to avoid giving information regarding best fishing areas to rival boats. So far, the cost of the scheme has been fully justified by the results attained. On the reception of storm warnings, all the vessels fly the customary visual warnings for the benefit of vessels not provided with wireless apparatus.

The American Government is reported to have purchased 50,000 wireless *receiving* equipments for use on fishing vessels. The apparatus is very simple, and costs only £24 per set, as against £300 for many equipments which have hitherto been designed for this service. It is hardly necessary to point out that such a price as the latter is quite prohibitive.

PROCEEDINGS OF INSTITUTIONS.

Correct Time.

By R. Myles Hook.

(*Abstract of paper read on October 14th, 1912, before the* Institution of Post Office Electrical Engineers.)

Since 1852 the Post Office has received an hourly signal transmitted automatically from the Mean Solar Clock at Greenwich Observatory, and at 10 o'clock every morning that signal was retransmitted by telegraph to every telegraph office throughout the kingdom, all the clocks being then reset by hand, which is still done at 9 a.m. daily. To provide watch and clock makers with a daily time signal sufficiently accurate to meet their requirements an instrument called the chronopher was designed by Mr. C. F. Varley. This was of the nature of a multiple change-over switch, operated by means of a spring motor, released by an electrical contact on a clock. The time signal from the Observatory was made to synchronise automatically the clock controlling the chronopher. The chronopher, as installed in those early days, is still doing useful service, but has become much overloaded. The temporary disturbance of the telegraph wires has also resulted in such inconvenience to telegraph traffic that it has now become necessary to introduce a new system.

The hourly signal continues to be transmitted from the Mean Solar Clock at Greenwich Observatory to the Central Telegraph Office in London, where it is received upon a main relay forming part of the new chronopher apparatus. The local side of this main relay operates other relays which transmit the hourly signal to London renters, and ring bells, &c., fixed in various administrative and operating departments of the group of buildings associated with the General Post Office headquarters.

Certain provincial offices have been chosen as sub-chronopher stations, and their circuits, regarded as main distribution circuits, are connected to the tongues of groups of switching relays which normally retain these circuits in connection with their telegraph apparatus, but which, when operated by control circuits from a special electrical clock, transfer the telegraph circuits from the telegraph apparatus, and bunch them on the tongue of a transmitting relay so that a positive current, which forms a preliminary or warning signal, is sent out on all distribution lines. On the receipt of the Greenwich signal, the operation of the main relay causes the transmitting relays to reverse the current on the lines momentarily, the reversal constituting the distributed time signal. At the provincial offices similar apparatus, but on a smaller scale, is installed for secondary distribution over other circuits radiating therefrom to individual offices, wherein hand-operated switches control the arrangement of the local circuits for transmitting the signal to subscribers' premises.

Special switching devices are introduced in the new chronopher to enable the Admiralty stations at Portsmouth, Weymouth, Plymouth and Deal to send reporting signals from their standard clocks (in the case of Deal from a time ball), which signals follow one another in succession over a second wire from London to the

* See also Electrical Review, Vol. 69, December 15th, 1911, pp. 974 *et seq.*

† Among the most recent results in this field may be cited Esau's work (see also "Z. f. S.," January, 1912, page 23). This investigator divides atmospheric conditions, as affecting the damping in "wireless" circuits into two groups—those electrical conditions leading to comparatively small effects, and those, such as hoar frost, rain and snow, leading to more pronounced effects. According to the existing electrification of the atmosphere, the damping experienced may vary 8-20 per cent, and can be definitely connected with the number of ions travelling to earth *via* the aerial. The damping increases with the transparency of the atmosphere, with rising wind velocity, with decreasing relative humidity, and with the formation of cumulus and nimbus clouds. There is a daily cycle curve of damping, which is smoother in winter than in summer, and an annual curve of damping shows maxima in June, August and December, and minima in February-March; July and October. Fog has little influence on the damping of the aerial, but up to 200 per cent. increase may be caused by a coating of hoar frost or ice; 100 per cent. by rain and 50 per cent. by snow

Observatory, and enable the Astronomer Royal to check the performance of the clocks. Distribution to the provinces takes place at 10 and 1 o'clock, and at the provincial sub-chronopher stations the switching relays are joined in groups for the 10 o'clock, 1 o'clock, or both signals according to the service required in any particular town. The controlling clocks are set so as to operate the switching relays from 1½ minutes before to 1½ minutes after the hours. The whole of the country is thus divided into convenient districts from the centre of which any town therein may obtain the time signal automatically and without inconvenience. This scheme is, of course, extremely elastic, and will enable growth to take place unhampered by considerations regarding the use of long and expensive telegraph wires. Instead of having upwards of 200 such circuits radiating from London as heretofore, only about 20 are required with the new system.

For watch and clock makers who have business with chronometers and precision timepieces, used for transport in surveying or navigation operations, the time signal is not generally directly used as a means for the correction of their regulator clock or the timepieces under test, but as a means whereby the constancy of their daily error or "rate" may be ascertained. For the determination of the rate nothing can be better than a single stroke on a gong, or some such audible signal. The firing of a gun, as is customary in a good many places, is useful as an audible signal only for places in propinquity to the gun, because of the time which elapses before the sound travels to a distant observer. For exact work it is the flash that is noted, when it can be seen. In an important city in the North, a great public clock—the standard for the city—is corrected by hand, and therefore may sometimes be appreciably out of time. This clock is provided with a bell, upon which the hours are struck, but whose note at 1 o'clock, whilst prepared for by the mechanism of the clock, is let off by the 1 o'clock Greenwich signal, quite regardless of the fact that, apart from the mechanical lag in the striking gear, the sound of the bell must take an appreciable time to reach the outskirts of the city. Quite a lot of expense must have been incurred in providing the special mechanism involved, and a comparatively large annual sum is paid for the signal, whereas for a much smaller capital and annual expenditure the clock itself might have been automatically synchronised, and the bells left to take care of themselves, as has recently been done at Aberdeen Town Hall, where the synchronising gear is so arranged that *all* the hours are struck exactly at the right time.

The most important visible signal is the time ball, many of these being in use to-day. This type of signal is the standard means for observatories to announce a certain hour—usually 1 o'clock—to observers within the radius of visibility. The most important duty of time balls lies in the means they afford to ships for checking the rates of their chronometers. For this purpose the Admiralty Dockyard stations round our south and south-west coasts have been provided with time balls; some dropped by the Greenwich signal at 1 o'clock, others dropped every hour by an electric current sent out from a regulator clock, which is corrected to agree with the Greenwich signal.

Another class of visible signal one sees in watchmakers' shops is the deflecting needle of a galvanometer. As it requires two observers—one to see the signal and one to observe the clocks—with the very considerable risk of personal error occurring between them, it cannot be of what one might call *scientific* value.

For the physical correction of clocks there are many methods. Hand correction may be dismissed at once as haphazard and most unscientific. There is, however, one really scientific method of what I may call electro-manual correction devised by Sir George Airey, which is used to-day—notably, amongst other instances, on the Mean Solar and Sidereal clocks at Greenwich, and also in the clocks at the Admiralty stations. In the Admiralty clocks are two pendulums, vibrating seconds, one suspended immediately behind the other. The one is entirely free on its suspension, but is normally latched to one side by a detent, which is released by the arrival of the Greenwich signal; the other, which controls the clock, has fixed to it a permanent magnet, which, with the vibration of the pendulum, swings just clear of the poles of an electromagnet fixed to the case. On the release of the free pendulum, should the clock be absolutely to time, both pendulums will vibrate in phase with each other, but if there be any variation, the difference in phase may be read on a suitable scale, and then a current is sent round the electromagnet in such a direction as either to attract or repel the permanent magnet; thus, by altering its effective centre of gravity, accelerating or retarding the clock pendulum until both are again in phase. These clocks are also provided with electrical contacts to enable them to report automatically their performance to Greenwich, and to drop the time balls. The Mean Solar and Sidereal clocks at Greenwich are corrected in the same way, save that, as their performance is observed on electrically-operated seconds indicating dials, by which the clock error may be compared with a transit observation, the free pendulum is not required. Up to quite recently this appeared to be the only method by which an error of a fraction of a second could be physically corrected, without involving a permanent alteration in the regulation of a pendulum. There is, of course, in this system, as in all systems where a personal element is introduced, some risk of personal error; but in the hands of skilful and trained observers, the foregoing method offers possibilities for very close correction indeed.

The majority of the methods for zeroising clocks by means of a synchronising current in use at the present time depend upon the action of a lever or roller caused to come into contact with, and push round, a spiral cam or its equivalent. With certain restrictions this method is reasonably good.

When it was decided that the Post Office should consider the question of automatic correction from a practical point of view, the methods previously in use were very carefully analysed, and, after experimenting at some length, we arrived at several rather important conclusions, amongst others that the periodic checking of a gaining rate—as in Ritchie's method—was fundamentally correct, because of the backlash that must perforce exist in any train of wheels; whereby any attempt to move a slow clock forward would disengage the teeth of the train from their driving position, which space would afterwards have to be gathered up when the correcting power ceased to apply, obviously leaving the clock incorrect to the extent of such backlash. This, of course, does not occur when setting back or checking a gain is concerned, for the engagement of the teeth of the train is not disturbed. An important desideratum recognised was that whatever might be the method adopted, the additional part or parts to be added to a clock must be of such design as to be readily incorporated in all the classes of clock in use in the Post Office from 10-in. timepieces up to comparatively large 36-in. dial clocks, and, above all, the cost of the apparatus and fixing it must be reasonably low.

A small electromagnet detent was therefore designed, which can be readily attached behind the dial of any timepiece, and in which the magnet has no positive work to do. A pin on the armature is arranged to project through a hole in the dial in such a way that, periodically, when the minute hand reaches the sixtieth minute, it engages with a flattened pin riveted to the hand. With the magnet unenergised, the pin on the hand easily pushes the detent pin to one side, and, because of the different arcs in which the two pins move, ultimately clears the detent, allowing the armature to fall back to its normal position upon the poles of the magnet. If, however, the magnet be energised, the armature is simply locked in position (which, of course, requires much less effort than actually to move the armature through any distance), and then, by the engagement of the pins, the clock is held up, the hands meanwhile slipping on their arbors without stopping the train, until at the cessation of the current the hands are allowed to progress. Such, then, is a synchroniser, which, when equipped with a pair of terminals, fixed to a clock and included in an electrical circuit having a suitable hourly signal thereon, is all that we require to enable an erratic timekeeper to be converted into one whose performance may be relied upon implicitly within an error limit of a fraction of a minute. The electrical resistance of the synchronisers used on Post Office installations is 10 ohms, and all the clocks in a building are connected in series or in series-parallel groups, the voltage at the master clock being regulated so as to afford a current value of about 250 milliamperes in each circuit, whatever be the number of clocks. Actually 100 milliamperes are ample, but it is found to be safer to allow a wide margin.

We have not standardised any fitting for correcting turret clocks, because these being usually made to order, one at a time, vary so much in constructional detail, that any attempt to apply a standardised attachment would be comparatively expensive. We, however, standardise the principle. It may be interesting to know that for a number exceeding six clocks in one building, the cost of the Post Office system, including all wiring and a master clock, which I shall presently describe, averages approximately no more than £1 per clock. It will, of course, not be overlooked that there remain the annual charges for maintenance and winding the synchronised clocks.

We now use a master clock, which is more of the nature of a time-controlled switch than a clock. This consists of a pendulum, electrically-driven on the Hipp principle, which, through a pawl and a ratchet wheel, drives a worm gear connected to a very simple train of wheels, embodying one-hour and 24-hour wheels. The 24-hour wheel is provided with cams which operate, at the proper time, electrical contacts controlling automatic switches or relays for the proper reception of the 10.0 and 1.0 o'clock Greenwich signals. The hour wheel carries a pin which once an hour, from about two minutes before the exact hour, depresses a lever to make the circuit for the hourly correcting signal. The lever is released, and thus breaks the circuit, precisely at the 60th second of the 60th minute of the hour. The arbor of the ratchet wheel carries a heart-shaped cam by means of which an electromagnet armature provided with a roller extension zeroises daily the whole of the train. It is, of course, obvious that synchronising by a cam in this case, on the quickest moving member of the train, is not open to the objection which would apply, as I previously remarked, to the same method applied directly to the minute arbor of a clock. Since these clocks were designed, a patent has been taken out by the Silent Electric Clock Co. for a master clock synchronising method which seems to be the most scientific, and promises to be the most efficient, system yet devised for the purpose. In this method Sir George Airey's method for barometric compensation is in part made use of. That is to say, the pendulum is re-regulated automatically to a degree proportional to the observed error of the clock, either fast or slow, by means of the effect of minute variations of an automatically adjusted magnet upon another carried by the pendulum. An arbor rotating once a minute, or once in a half-minute, carries a small two-segment commutator which carries three brushes. These are disposed about the commutator in such a way that if the clock be absolutely right upon the receipt of the time signal, one of them, which is connected in the local circuit of a relay on which the signal is received, rests upon the insulation between the segments, whilst the other two rest, one upon each of the segments. If the clock be right, the local circuit is therefore disconnected, but if it be fast or slow, the local circuit is completed through one or other of the brushes to either of a pair of electromagnets, whose armatures, by means of a step-by-step propulsion mechanism, rotate a wheel, one step at a time, forwards or backwards, and thereby cause the magnet to recede from or approach the

vibrating member and so retard or accelerate the rate of the pendulum.

As the corrections are applied by minute steps, one at a time, the clock, when set up, may be roughly regulated, and then left to regulate itself. The corrections will operate time after time, until the clock finds itself correct, when they will cease to be effective. Should the distance through which the correcting magnet moves be so great that if, when the corrections have matured, it is found that the next correction has a tendency to transfer the error to the opposite rate, the initial position of the correcting magnet may be varied by hand, so that the actual effect of each step in its movement may be varied within a wide range. This, in itself, offers possibilities for comparatively coarse or extremely fine correction—possibly closer than normally possible by hand regulation. Should this method, upon trial, be found to be as perfect as it seems, there is no doubt but that it will be adopted for Post Office purposes.

This master clock, of course, is also used as the control clock for sub-chronopher stations in connection with the new time distribution scheme, to which I referred earlier in the paper. I may add that, recognising the fact that telegraphic interruptions do occur, the electrical circuits are so arranged that a false synchronising signal cannot be accepted by the clock, nor can the entire failure of the signal interfere with its normal going.

The foregoing, then, is the scheme which the Post Office has adopted for ensuring the observance of correct time at offices where spring or weight-driven clocks are already in existence, and the extension of the system is being proceeded with as rapidly as convenient.

Synchronisation such as this, is, after all, but a sort of compromise. It is useful where a number of clocks exist which cannot well be scrapped. But it is evident that personal attention is still necessary, for they have to be wound up.

Types of electrically self-wound clocks, suitable for synchronisation, there are in plenty; there is now operating in London a firm who are selling, and leasing upon rental terms, clocks of this class. But it seems to me that it is a singularly roundabout way to achieve the object when, if one must depend upon electricity for the provision of an exact time service, that object can be attained by the use of such simple and inexpensive mechanism as the modern electrically-propelled clocks, driven by electrical impulses from one master clock.

So far as the Post Office itself is concerned, where the equipment of a new building, or one hitherto not adequately provided with clocks is in question, we should invariably install a purely electric system whose master would be automatically synchronised. H.M. Office of Works have equipped many buildings, including post offices, with the Magneta clock system. They have not, however, gone so far as to arrange for the automatic control of the master clocks, preferring apparently to rely upon the personal correction made, if necessary, when the master clocks are manually wound up daily, as is necessary with the Magneta system.

Premising daily synchronisation by a Greenwich signal, exact time-keeping qualities are really not of prime importance, and in my opinion an ideal system should consist of a master clock, which should be entirely independent of personal attention for winding or correction, lending itself readily to automatic correction, and connected to secondary clocks in which the moving parts should be as few as possible and coupled with driving mechanism of the rotary type—akin to an ordinary electric motor. In 1896, when the Post Office acquired the telephone trunk wires, we found the need for large clocks indicating periods of ¼ minute, and those which were then made in accordance with the design of Mr. Kempe were operated by rotary armatures. These clocks, made more than 15 years ago, are still in use and are doing their work satisfactorily, much more so, I feel sure, than if they had been driven by ratchet work, which would have involved some measure of adjustment to take up wear, and more or less variable springs which are almost inseparable from that type of gear. These particular clocks, designed a long time before the electric clock industry had reached its present stage of perfection, are rather unique, inasmuch as the third concentric hand revolved once a minute in four jumps of a quarter of a revolution each ¼-minute, involving a little mechanical problem not quite easy of accomplishment, but so easy, when done. The clocks were made in two sizes with 24-in. and 5-in. dials, similar driving mechanism being employed in each size. Their functions are now, however, being performed by Calculographs and time clocks.

Where master clocks are synchronised, whatever be the method adopted, arrangements should be made that the operation be *entirely* automatic and not dependent upon manual attendance in the event of any failure of the signal.

When one considers how very essential, for the correct operations of commerce, is a rigid adherence to a uniform standard of time, it is a matter of wonder to me that so few persons who would not, nor could, dispense with means for ascertaining the time, do not go one step further and insist upon the time which they make use of being correct time. Correct time is fully appreciated, and any increase in the facilities for accurate and wide distribution is welcomed and made use of without stint, by our Naval and Mercantile Marine.

We now have the benefit of the radio-telegraphic stations on the Eiffel Tower and at the mouth of the Elbe transmitting time signals for the benefit of all who have means for listening to them. The cost of the apparatus necessary for the reception of these signals on ships unprovided with radio-telegraph apparatus is from £10 to £20, not a large sum when compared with the immense value of the service thus obtained; and aerials having an elevation of 20 m. are sufficient for vessels within a radius of about 200 miles. I may add that the facility afforded by radio time signals is of immense value in surveying operations, for, by this means, most minute differences in longitude can be calculated.

Institution of Electrical Engineers.

ON Monday last week MR. W. C. MOUNTAIN, M.I.M.E., delivered his inaugural address as chairman of the Newcastle Local Section of the Institution. Referring first to the gratifying activity prevailing in the electrical trades, he expressed a hope that means might be found to diminish excessive competition between British manufacturers. The address related mainly to the application of electricity to mining purposes, with which he had been associated for many years, and which was now making very rapid strides. He did not think that the West Stanley colliery explosion was due to the use of electricity, though it led to the revision of the Home Office Rules, which, in their new form, would involve considerable modification in many old installations. Their main object was to ensure a good mechanical protection to all cables, an efficient system of earthing, and improvement in the design of switchgear, together with better supervision of electrical plant underground. After reviewing the requirements embodied in the new Rules, and pointing out the great expense that would have been entailed if collieries, already well equipped and with no accidents recorded against them, had not been exempted from complying with them until 1920, Mr. Mountain discussed the action brought against Mr. Imrie, manager of the Chopwell Colliery, by the Home Office, on the ground of non-compliance with the rules, which was decided in favour of the former; he considered that the case had been dealt with by the technical Press in a somewhat harsh manner, as the Consett Co., who owned the colliery, had installed armoured cables, and were as quickly as possible meeting the new requirements.

In the North of England coal-owners were fortunate in having one of the largest electric power companies available, and given a cheap supply of electricity, they were well advised to take advantage of it. But in many districts there was a large amount of unsaleable coal which was sufficiently good for steam production, and waste heat and gas could also be profitably utilised; hence it was gratifying to see that private power stations of considerable size were being installed all over the country. With exhaust steam turbines, after allowing for all charges, the cost of generation had been as low as 0·15d. per unit, and in many cases under 0·2d., though the load factor was only about 30 per cent.

Regarding electric winding, for heavy work and with cheap coal or waste heat available, he still thought the modern steam winding engine the cheaper system of winding; but for small outputs there was a very large field for electric winding, and a very considerable amount of work was being done in this direction. The use of helical-cut gearing had assisted greatly, as it enabled smaller and cheaper motors to be used. The simple induction-motor was quite suitable in cases where the peak load when starting did not cause any trouble. The use of a motor-generator introduced risk of breakdown. For cables in mining work he preferred those insulated with bitumen, provided there was no risk of decentralisation of the conductors. The pillar type of switchgear, with draw-out arrangements for isolation, was very satisfactory for use underground. Care must be given to the earth connection of the armouring of the cables to switch cases, as well as to the junction boxes, controller cases and motor frames. The slip-rings of motors should be enclosed if there was any likelihood of gas being present, but he did not consider the total enclosure of large motors satisfactory. Broadly speaking, total enclosure was a mechanical protection only, as doors or covers might be left improperly secured; and where there was any positive danger of gas in part of a colliery, it was better to install compressed air there. Electrical compressors could be employed near these places, but the average disk coal cutter consumed about 600 cb. ft. of free air per minute at 45-50 lb. per sq. in., and each such machine would, therefore, require 70 to 75 H.P. in the motor-compressor, the resulting efficiency being 30 to 40 per cent. compared with the direct use of electricity. Taking the horse-power at £5 per annum, this meant an additional annual expenditure of about £250 per coal-cutter.

Three-phase coal-cutter motors might be wound for as low a pressure as 110 volts, which could not cause a dangerous shock, a small transformer being combined with the gate-end switch. High-pressure current could then be brought by small cables near the working face, and possibly the total cost would be lower than if the standard voltage of 500 volts were adopted.

For high, lifts the three-throw plunger pump was better than the centrifugal pump, in point of efficiency, the combined efficiency often being as high as 80 per cent. Single-reduction helical gear had improved the efficiency, but it ought always to run in oil. For large volumes of water at moderate heads, the centrifugal pump was better. Portable pumps should be of three-throw type. Electric haulage had made enormous strides, its economy being unapproachable. Some years ago, Mr. Mountain substituted an electric for a compressed-air haulage, with the result that the engine I.H.P. was reduced from 500 to 166. As regarded the driving of rolling mills, very great economies could be effected by the electric driving of many of the rolls, live rollers and other auxiliary machinery, but he doubted whether a real commercial saving could be effected in the case of very heavy reversing mills.

Electric refining of steel, electric traction on railways, ship propulsion, and other developments, were also touched upon by Mr. Mountain, who, in conclusion, said he felt that a consulting engineer ought to be willing to accept makers' standards as far as possible, and should give the manufacturer a fairly free hand as regarded design; he should clearly specify his requirements and

the conditions under which the machinery was required to work, and call upon the manufacturer to provide information regarding the construction of apparatus, which would enable the engineer to form a decision based upon the merits of the plant and not only upon price. A low tender often proved in the long run to be by far the most expensive offer. He had no sympathy with some of the claims for consequential damages which had been brought against electrical manufacturers and engineers in the past; the purchaser could easily be protected by a fair and equitable contract.

LEGAL.

The National Telephone Arbitration.

(*Continued from page* 653.)

Mr. William Slingo, continuing his evidence, said that the total number of the larger magneto exchanges was 168, and one or two of the 41 which had been replaced with the battery system were not multiple exchanges. He had had 31 multiple magneto exchanges inspected. He estimated that it would take about six years to clear out all the magneto exchanges. In certain cases the magneto telephone was connected with the common battery exchanges, he believed there were some 23,000 instruments so connected; in most cases their life was over, and they ought to be withdrawn from the service and replaced with the central battery system as soon as possible.

Further questioned, Witness said that he could deal with the whole plant within two years and with the employ of 15,000 men.

Counsel: Would you have any difficulty in obtaining that number of men to put on work of this description?—I do not think so; I have at the present time 12,000 men doing maintenance and construction work, and I could undoubtedly get more. The total length of telephone wires of the Post Office amounted to 464,958 miles.

Cross-examined by Sir A. Cripps, Witness was pressed very closely as to the reason why in making up the Post Office estimates he did not proceed upon the lines of taking the cost of the work executed and the plant placed in the Post Office telephone system, and then comparing it with the cost of similar work and plant belonging to the Telephone Co., making due allowance for the variety of plant and difference of conditions, instead of proceeding upon what Mr. Snell called the "contractor's basis." He maintained that, with so many variations and differences in the construction and nature of the work and plant involved in the establishment of the two systems, it would not have been practicable to adopt the course suggested.

Questioned as to the number of telephone stations under the Post Office on December 31st, the date of the transfer, and March 31st, the date of the lease, Witness said the number of stations in London on March 31st was 74,146 completed and working, 398 completed and not working, and 10,025 private-wire stations. On December 31st, the number of exchange stations in London was 79,835, and in the provinces 39,160.

Cross-examined with regard to aerial cables, Witness said that the average life of a properly constructed vulcanised-rubber cable was about 12 years, and that of a rubber-covered dry-core cable, which was not so long-lived, was no more than nine years. The lead-sheathed cable had a life of about 15 years. A great deal of the aerial cable would be replaced because so much of it was faulty, and also because the Post Office desired to replace it by the underground system. He thought the two varieties of rubber cable should be taken down at once. They were giving so much trouble with the working circuits that this course was desirable.

His Lordship: Do you mean to say that, in some peculiar way, the performance of their duties ceased with the transfer of the company's system?—Witness said he did not mean to suggest that. The cables were in an unfit condition for the work they had to do, and dry air was being pumped into them every night in order that they might work the next day. They needed desiccation continuously and changing of wires.

His Lordship: In other words, you think they are used up?—I do.

Sir A. Cripps: How long did you think the lead-covered cables would remain *in situ* when the transfer was carried out?—Witness pointed out that he had fixed the life at 15 years.

On re-examination by the Solicitor-General, Mr. Slingo said, referring to the effect of electrolysis, that, until a cable was taken up in all its length, it was quite impossible to tell whether electrolytic action was going on in underground cables. So long as the lead was continuous in any thickness, there was no fault. The effect of electrolysis, he said, was variable—the greater the current the greater the amount of lead eaten away. He distinguished, of course, between the gradual chemical action of electrolysis, and the sudden melting effect of a strong current accidentally assailing the lead. As long as any ordinary stray current ran along the lead there would be no decomposition. It was where current escaped that the electrolytic action occurred. The current, however, might choose to take the pipe rather than the lead, and at a manhole or surface box, or wherever there was a break the current would pass into the lead across the gap. In order to avoid that, it was the practice of the Post Office wherever there was a break to join iron pipes by a lead strip, technically known as a "bond." When the cable was laid in a non-metallic conduit, the cable was connected by wire to an earthplate buried in the ground, so as to take away any stray current which might be travelling along the lead sheath. That was technically known as "earthing."

As a matter of fact, do you find that you do avoid the risk of electrolytic action to a very great extent by this "bonding" and "earthing"?—Oh, yes. The National Telephone Co.'s cables, he said, were neither "earthed" nor "bonded," and were, consequently, more subject to electrolysis.

Mr. Justice Lawrence reminded the witness that he had himself exhibited a portion of lead-sheathed cable rendered faulty by electrolytic action.—The Witness admitted it.

Mr. Justice Lawrence: Then, though you adopt methods for obviating this damage, they don't always succeed?—Mr. Slingo said that was so, but explained that it greatly minimised the danger, so that he had no doubt the Post Office cables suffered much less from the effects of electrolysis than the cables of the National Telephone Co. It would be possible still, he added, to "bond" or "earth" the cables taken over from the National Telephone Co., but that would not remedy the damage already committed. It was the experience of the Post Office that, since the adoption of these two devices, faults in cables had been much rarer than before.

Witness said he agreed with the estimate of the company as to the life of aerial cables—15 years for lead-covered, nine years for rubber-covered dry core, and 12 years for vulcanised rubber-covered cables. In conclusion, he said the stations of the Post Office and those of the company could not be properly compared as to cost, those of the Post Office being much the more costly, for many reasons, among which was the fact that the Post Office provided a larger margin of spare plant than the company.

In the course of further evidence, Mr. Slingo said the Post Office would remove the aerial cables taken over from the National Telephone Co. as soon as possible. The coverings of these cables were either vulcanised rubber, india-rubber or lead. The first two of these were not now being used in new telephone work in this country, and the aerial cable was only being used where it was practicable to have a lead covering. Where it was possible to avoid it, however, the Post Office did not put up aerial cables at all.

Mr. Buckmaster: Can you use aerial cables in the county of London?—We have not any. The Telephone Co. has, but we are going to take them down.

Answering further questions, Witness said that rubber-covered dry-core cables were very subject to developing faults. Out of 42,948 miles of these wires taken over there were 14,000 spares. It was only the spares that could be tested, and of these 80 per cent. were found to be faulty.

Mr. Buckmaster explained that these questions were asked witness with a view of showing the amount of depreciation in the aerial cables taken over. The parties had agreed upon the cost of construction, it was true, but there remained the question of the life of the plant as determined by the degree of depreciation. His object was to show that the life of the plant was shorter than the National Telephone Co. said it would be, and that consequently the agreed figure for cost of construction must be reduced by a greater amount than the company reckoned.

Witness said the proportion of cables covered with vulcanised rubber which had been found faulty was 20·48 per cent. as compared with 80·06 for rubber-covered dry-core cables.

Mr. Buckmaster: What are the causes which lead to lead-covered cables becoming useless?—Vibration, lightning, atmospheric fumes in certain districts, occasional wholesale damage by fire, &c., were all factors causing depreciation of cable. He considered that the use of vulcanite and india-rubber-covered cables was dead. Lead-covered cable would have a life of probably 15 years. He had not had much experience of bare wires in this connection, but the life of bronze wire should be materially shorter than that of copper wire. It was very much thinner, and therefore more liable to break down.

Examined next with regard to exchange equipments, Witness said that the magneto exchange instrument would not be retained in use for a longer period than was necessary. They would all be converted in the common-battery system. The common battery was more rapid in working and more satisfactory than the magneto system. The latter was admittedly out of date at the present time. Since the Post Office had taken over the National Telephone Co.'s system, they had replaced the magneto with the central battery in 41 of the larger exchanges, and in 74 of the smaller exchanges they had taken away the magneto system and installed the common-battery signalling equipment.

Mr. James O. Callender, one of the assistant managers of Callender's Cable and Construction Co., Ltd., and joint manager of the Anchor Cable Co., Ltd., on examination by Mr. Buckmaster, K.C. (for the Postmaster-General), said Callender's Cable Co. contracted both for the supply and the laying of cables; the Anchor Co., for the last five years, had confined themselves to supply. Callender's Co. contracted to lay in conduits prepared for them, and also to construct and prepare the conduits themselves. During the last 10 years he had estimated for and supervised contract work costing over £5,000,000 in this country and abroad. His experience in telephonic work had not been so great as in the supply and laying of electric light and power cables, but he had supplied and laid a number of telephone cables in this country. There was no difference in the cost of operations and handling between these and telephone cables.

Mr. Buckmaster: What does the cost of supervision include, so far as contractor's work is concerned?—Primarily the salaries of the engineers engaged in supervision work, the cost of such clerical assistance as they need, rent, rates, and taxes of stores, and petty cash for stationery, &c.

What do you add to cover these items?—Twenty per cent. on the cost of labour.

What do you include in the cost of labour?—All labourers, workmen of all kinds engaged in handling and laying the cable, jointers and jointers' mates, foremen, watchmen, storekeepers, labour for handling at the stores, and workers of every description, in short. When a contract is made for the supplying and laying of cable, the work is placed in the hands of an engineer, who sends to the works for any material he requires, and it is the duty of the works to supply the material at any point he may direct within the ordinary cartage limit of the railway. Anything beyond that is debited to the contract. All charge up to that point is a charge against the material. So far as plant and tools are concerned, we keep a central depôt at the works, whence they are issued to the contract as required. In the case of large plant a rent is debited against them, small tools on their return to the depôt are valued at what they are then considered worth. There was nothing added in respect of storage of material. His company kept a store in every town in which they did work, but that was included under the head of supervision. A very slight percentage of the heavy material ever went into that store. They would make the same arrangement for supplying a contractor that they did when they were themselves contractors, if he asked that to be done, as he certainly would do if he knew his business.

What do you add for the contractors' profits?—Ten per cent. on the labour plus supervision. Five per cent. is generally considered a correct figure for administration, preparation of plans, &c., by the people for whom we do the work.

The Witness said he had prepared a complete schedule of the cost per mile of the cables required for replacing the National Telephone Co.'s system, as at December 31st, 1911. He estimated for the supply only not for the laying; but his company would have been pleased to contract both for supplying and laying them. The output of his company, however, was not sufficiently great in telephone work to warrant them in undertaking to supply and lay the whole system within two or three years, but they would have been prepared to undertake one-fourth of the amount, and there were five or six other firms carrying on a large business in the supplying and laying of electric cables in this country.

In answer to other questions, Witness said he did not anticipate that there would have been any difficulty in getting the necessary copper, which was estimated at about 6,000 tons, in the system of the National Telephone Co.

Sir Alfred Cripps said it was 13,000 tons.

Mr. Callender explained that he spoke of cables only, not of overhead wires.

Mr. Buckmaster: Do you anticipate that there would be any disturbance of the market if an order for, say, 6,500 tons of copper were placed at a particular time?—No.

Mr. Danckwerts (for the company): For immediate delivery?—Certainly.

Mr. Callender proceeded to explain that if a person wanted to buy 6,000 tons of electrolytic copper at any one time, he would be faced by the double difficulty that he could not get it and that he would probably put the market up against him. But he could go into the market and buy 6,000 tons of standard copper. Then when he required the electrolytic copper from time to time he would go to the drawer and tender his warrants for the standard copper, together with the difference in price between the two qualities of copper, and get his electrolytic copper.

Mr. Justice Lawrence: Is not there a risk that you could not get it?—There is no risk, my Lord, because I could go to the standard refiners and get it there.

Mr. Justice Lawrence: We were told that they were chiefly in America.—They are, but there are two in this country.

We have been told that the copper market is very sensitive and somewhat erratic.—It is both sensitive and erratic, my Lord.

Mr. Justice Lawrence: Then I should have thought there would be a risk in the matter.

Mr. Callender thought not. The difference in price between standard and electrolytic copper, he explained, was about £3 per ton. The maximum variation between the two kinds during the last 10 years had been £4 10s. a ton, and they had come as near each other as 25s. So all the buyer had to do was to provide for any variation in the difference.

In cross-examination by Sir Alfred Cripps, K.C. (for the company), Witness said his company had supplied and laid telephone cables to the value of £25,000 annually in this country alone during the last 10 years. If he were to reckon those supplied abroad the total would be a very different one. He estimated that the cost of carrying out a contract within a limited time was not more, but rather less, than where the work was extended over a long period. The cost of supervision, for instance, would be less where the work was carried through rapidly.

Mr. D. C. Jackson, a civil and electrical engineer in America, and member of other similar bodies in that country, on being called to give evidence for the Postmaster-General, and examined by Mr. Branson, said he was a member of the firm of Messrs. D. C. and W. M. B. Jackson, engineers, of Boston, Mass., and Chicago. He himself was Professor of Electrical Engineering in the Massachusetts Institute of Technology. His firm, he said, were consulting engineers, dealing with electric lighting, power and telephones. He was engineer to the Massachusetts Highways Commission, a quasi-judicial body having control of the rates and service of the telephone companies in the State, and he had had to give his attention to both these points. He had also had experience as to the capital outlay required for putting up a telephone system, and the question of the life of plant. His telephone practice alone had covered nearly a million stations during the last few years. The Witness said he had paid three special visits to this country at the invitation of the Post Office for the purpose of advising as to the best method of inventorying and valuing the National Telephone Co.'s plant. He had inspected the plant in 12 of the 98 centres of the company's system, and had made an examination of 57 of the company's exchanges, including 15 of the larger ones.

Objections were raised to the witness's qualification as an expert in this country, but the examination was allowed to continue.

Mr. Jackson then, in reply to Mr. Branson, said that if he had to ascertain the value of the plant in the National Telephone Co.'s system at a particular day, he should look upon the cost of construction as estimated by a contractor or contractors as the best method of determining the question. To that he would add the cost of the undertaker's administration.

Mr. Jackson, continuing, said he had himself been a contractor engaged in the construction of electric light, power and railway systems. He was at one time at the head of the contracting department of the Edison General Electric Co., dealing with contracts amounting to from three-quarters of a million to a million pounds per annum.

Mr. Branson: What figure would you add for contractors' supervision?—20 per cent., or perhaps less, to the cost of material, freight, labour, casualty insurance, cartage and other associated costs. That 20 per cent. would cover such costs as the contractors' office or staff as far as wages and salaries are concerned, and the establishment charges. His own experience with the Edison Co. was that they never approached 20 per cent. for such costs.

Mr. Justice Lawrence did not see how the witness could put the cost at 20 per cent., if in his experience that percentage was never approached.

The witness said 20 per cent. was the outside figure to be estimated, and where a man had a chance of making a profitable contract he would put this cost at the maximum. His own experience never exceeded a cost of 15 per cent, but he had made contracts in which he allowed 15, 18, and 20 per cent. For contractors' profit, he would add 10 per cent. to the figures already discussed. If the contractor were himself the manufacturer there was a difference. When he was with the Edison Co. the contracting department was never expected to make a profit upon the plant supplied by them, but it was expected to make a 10 per cent. profit on labour and everything bought outside.

For the employer's work—making the contract, inspecting materials during construction, finally making the approval of the construction and certifying for the payment of the contractor, he would not allow more than 5 per cent. The amount of the employer's burden would be proportionately less in a large contract than in a small one. It would be more expensive to build up a system piecemeal than by continuous work.

The Witness was then examined as to the probable effect on the market of 13,000 tons of copper, the amount used in the National Telephone Co.'s system. The annual output of electrolytic copper in the United States, he said, was about 600,000 tons, about half of which was exported. The output of the rest of the world was from 100,000 tons to 125,000 tons, so that the proportion of the amount of copper contained in the company's system spread over two years represented 9 per cent. of the world's output. The average visible supply of copper at any one time varied from 100,000 to 300,000 or 400,000 tons.

Mr. Branson: Is it your view that a purchase of 13,000 tons of copper would have any effect upon the market?—No, not if made judiciously. If a contractor had an order to build a plant containing 13,000 tons of copper, he would have all his copper purchased within a few weeks, for delivery as he wanted it during the term of his contract, without any disturbance of the market. As the English market drew a very large proportion of its supplies of copper from the American producers, his experience in America was applicable to this case.

The lead in the company's cables Witness estimated at 38,000 tons. The annual output of the world was over 1,000,000 tons, and the purchase of 28,000 tons would not affect the market. The same answer applied to the purchase of the 900 tons of tin used.

Witness said the small magneto switchboards used by the company were identical with plant used in America, and he put both the physical and effective life of these at 10 years, and about the same for large magneto switchboards. He put the physical life of the common battery plant at 15 to 20 years, and its effective life at 10 years, the shortness of the effective life being caused by the rapid and steady development of the art of telephony. Subscribers' apparatus he gave an effective life of about 10 years. The best way of computing the depreciation value of a plant, he said, was first to take the estimated effective life of each species and the age at the time under consideration; from these one could compute the balance of expectation of life and compare it with the value of the new plant, adding the salvage value of the plant.

The cross-examination was deferred.

Mr. Alexander Siemens, President of the Institution of Civil Engineers, &c., said his firm had been engaged in all kinds of electrical work for many years. They had laid eight Atlantic cables. He had seen the estimates put forward by the Postmaster-General in thi arbitration, and agreed with it. He thought it was ample. Witness put the cost of contractors' supervision at 21 per cent., contractors' profit at 10 per cent., and contracting engineer's fee at 5 per cent. Nor further provision was made for ordering and storing—in fact, in work of that kind, no store was necessary, because the plant was only delivered where it was needed. Where his firm were both contractors and manufacturers, the supplies were kept in store at the works until they were wanted, and that was the usual practice. Mr. Siemens said his firm could undertake to complete the whole of the National Telephone Co.'s system in 2½ years, both underground cables and overhead wires, by restricting the number of outside orders for the same period. His firm was using about 2,000 tons of electrolytic copper per annum in their work at

Woolwich, but that could be increased to 4,000 tons, so that without disturbing their general business they could apply 2,000 tons to this telephonic business. And if necessary the works could be extended within six weeks. He did not anticipate any difficulty in getting enough labour either inside or outside for the completion of the contract. There might be some difficulty at first in getting a sufficient supply of jointers, but these could be trained in two months. The work could be carried on at as many different points as were necessary to expedite it. If his firm here had any difficulty in turning out the cable he would get the help of the houses of Siemens in other countries which dealt with 30,000 tons of electrolytic copper a year. The Berlin house alone was now consumg 80 tons a day, or at the rate of 24,000 tons a year. Witness said his firm laid the original telegraph lines in Russia in '57, in Argentina and Brazil, and had done a great deal of work in India. His firm, he said, wrote off 10 per cent. a year on all their plant, so to say, leaving 90 per cent. of the original value at the end of the first year, then 10 per cent. on that, and so on in diminishing principal.

In cross-examination by Mr. Danckwerts, K.C., Mr. Siemens said he required to make no calculations in order to arrive at an agreement with the estimates of the Post Office. He would not have known his business if he had not been able to do so without fresh calculation.

In re-examination by the Solicitor-General, witness explained that the integral parts of the cost of cable were 90 per cent. for material, 5 per cent. for making, and 5 per cent. for establishment charges. When the works were run at night, the increased cost of labour was balanced by the decreased cost of establishment charges. He added that the representatives of the firms of Siemens in various countries were in the habit of having periodical conferences on the condition of business, and as the result of one of these, they were now erecting large telephone works at Woolwich. "We think there will be a demand for telephones now," he said.

Mr. G. W. Cook, a retired superintendent engineer of the Post Office, gave evidence to show that several of the cement conduits of the National Co. were, on inspection, found to be defective, mainly on account of the cement blocks getting out of alignment.

Mr. Geo. Wm. Hook, on further examination by the Solicitor-General (Sir John Simon), spoke of a case in Plymouth where the blocks in a cement conduit of the company had become so far out of alignment that they could not get a mandrel through, and one was actually lost in the duct.

Mr. Justice Lawrence said he did not see how that affected the case.

The Solicitor-General said the parties had agreed a value to be put upon these cement block conduits when they were new. Now the Court had to determine how much further life was left in them. The view of the Post Office was that their present condition was such that their remaining life was very short. Supposing the Post Office showed that there was reason to think that in a substantial part of the whole these blocks were out of alignment, with the result that there was not a 3-in. hole left, they were already in a condition when they had served their best years and had become inefficient, almost obsolete conduits. That, he thought, would have a bearing on the question of life.

His Lordship said the condition of the conduits would, of course, be taken into consideration, but he would not allow himself to be influenced by the loss of a mandrel.

The Witness said that the 3-in. conduits of the company should have taken a 2¾-in. mandrel if they had been clear, but out of 183 miles examined by him, 30·657 of the conduits were blocked to the 2¾-in. mandrel, 23·217 would take a 2½-in. mandrel, 2·476 would take a 2-in. mandrel, and 4·964 were below that.

Sir Alfred Cripps (for the company) asked if it was not the case that all except a very small proportion of the company's cables would pass through a 2½-in. or even a 2-in. duct.—Mr. Hook said he did not know that, but pointed out that the trouble was a progressive one.

Mr. Jackson was recalled for cross-examination, but Sir Alfred Cripps declined to ask any further questions.

Mr. Wm. Aitken, M.I.E.E., on examination, on behalf of the Postmaster-General, by Mr. Branson, said he had been exclusively connected with the telephone industry for 30 years. For 10 years he had been in the employment of the British Insulated and Helsby Cables, Ltd., during part of that time as telephone engineer in charge of their telephone manufacturing works, now formed into a separate company under the name of the Automatic Telephone Manufacturing Co., Ltd. His company had supplied 25 trunk and 11 common battery exchanges to the Post Office, and had also supplied plant to the National Telephone Co. Upon the agreed figures for cost of labour, tools, &c., used in the construction of a telephone system, he estimated that an allowance of 20 per cent. should be made for supervision, with 5 per cent. on freight, cartage, &c., to cover the money laid out on that account, if competition were not very keen, but if it were keen 15 per cent. would probably have to go. There would be nothing to add beyond that on that head. For contractors' profits he would add 10 per cent. on the cost of labour, tools, &c. As contractors they added no contractors' profit on plant manufactured by themselves, but on goods bought from other manufacturers they added 5 per cent. The manufacturers' profit on plant, he said, was about 10 per cent, but it varied very much. Witness said he agreed with all the estimates on exchange equipment, subscribers' apparatus, &c., and his company would be prepared to undertake the contract to replace these on the National Telephone Co.'s lines on those terms within three years.

In cross-examination by Sir Alfred Cripps, Witness said that the capital of the Automatic Telephone Manufacturing Co., Ltd., was £1,000,000, but he did not know how much had been paid up. The company, he said, had only been in existence, as such, for nine or ten months, but it had previously been long engaged in large contracts as the British Insulated and Helsby Co.

Mr. Sidney George Leech, a joint managing director of J. B. Saunders & Co., Ltd., and a M.I.E.E., said his firm's office was in Westminster. His firm, he said, were contractors only and not manufacturers. They were engaged in the construction and maintenance of overhead telephone and telegraph lines, also on electric light and power lines carried overhead. At present they were maintaining the telegraph systems belonging to 24 of the smaller railway companies. Having no factory of their own, they bought the supplies necessary for any construction work they undertook. For supervision in the erection of poles and standards, and the placing of bare wire and aerial cable, he estimated that 19 per cent. should be charged on the cost of tools, &c. Contractors' profit he never estimated at more than 10 per cent., but it was usually less. He also charged a percentage of the material bought for the work. He allowed nothing for storage.

In cross-examination by Sir Alfred Cripps, Witness said the amount of telephone construction his company had done during the last five years under contract was negligible, and as regarded telephone work for the railways, whose telegraphs and telephones they maintained, he could not separate construction from maintenance. The annual figure under both these heads was, roughly, £30,000. He thought supervision and administration would cost more where work was spread over a long period than when it was executed in a short time, but labour would not.

In re-examination, Witness said the 19 per cent. which he estimated for supervision and administration was arrived at by reference to the actual amounts shown in his firm's contracts.

Mr. Andrew Young, valuer to the London County Council for the last 24 years, on examination by Mr. Schwabe, said he would allow 5 per cent. for headquarter administration, of which 4 per cent. would go to the engineer to provide for the cost of devising the scheme of the work, for preparing all designs, plans, estimates and other documents, supervising the work, providing a drawing office and other engineers in charge of the construction of the work, and any machinery that might be necessary for the inspection and testing of any materials, &c. He allowed 10 per cent. on the fundamental cost for contractors' profits, and said the contractors in that 10 per cent. included all contingencies. In preparing a contract, an engineer might make a separate allowance for contingencies, but the contractor would not do so. If the sum so allowed by the engineer were not wholly expended, the residue went back to the employer. But there was no need of a contingency fund in the case of work that had already been executed. He said he had never before heard of a charge for interest on plant, and as for the cost of obtaining subscribers' agreements, he thought that ought rather to be a charge upon the business than upon the construction.

Mr. Justice Lawrence: Supposing the purchaser takes over the subscribers and their agreements?—Then I consider that the profits come in there, and under the Tramways Act we are not allowed to take profits into consideration.

Sir James Woodhouse: Are you aware that the Post Office, before they go into a district, canvass a district in order to ascertain the probable number of subscribers?—They may do so.

Would that, in your view, be any part of the cost of constructing the exchange?—No, my Lord. I consider it should be taken out of the revenue, and not added to the capital value.

In cross-examination by Mr. Danckwerts, Witness said it was his experience that contractors were willing to accept a 10 per cent. profit, but he could not estimate how much contingencies and establishment charges would reduce that, before the actual net profit of the contractor was ascertained.

Mr. Justice Lawrence: Have you made any estimate of what his net profit is to be?—No, my Lord. I only know that contractors will accept contracts on the 10 per cent. basis.

In answer to other questions, the Witness said he had valued the plant only, in the ordinary way; if he had had to value the system as a going concern, of course the value would have been considerably greater. He made no allowance for obsolescence of plant.

In re-examination by Sir John Simon, Witness said that the plant of the undertaking would be of no more value because it was taken over as a going concern. The increased value belonged not to plant but to goodwill. He was strongly of opinion that a sinking fund basis was not a proper one to apply in order to ascertain the value of a plant which was not new.

The Solicitor-General said the Post Office would finish its evidence this week, and he suggested that a break of a few days might then be made before arguments were entered upon. That would allow Mr. Snell and Mr. Gill to complete their efforts to simplify the mode of determining the life of plant.

(To be continued.)

Compensation Claim.

There was a settlement on Monday, at Blackburn County Court of the case in which John Thomas Watson, electrical engineer, Royal Terrace, Darwen, claimed £222 from Messrs. Dick, Kerr & Co., electrical engineers, of Preston, on account of the death of his son, Evan, who was killed whilst working at respondents' works. The father set up a claim of partial dependence, and it was decided to grant him £78.

Attorney-General *v.* London Electric Railways Co.

On Friday last Mr. Justice Neville, in the Chancery Division, had before him the motion by the Attorney-General, at the relation of the Gordon Hotels, by which it was sought to restrain the defendants until the trial of the action or further order, from pumping at their works on the Embankment in a manner which, it was alleged, was calculated to damage the relators' property.

Mr. Felix Cassel, K.C., and the Hon. H. B. Ponsonby were counsel for the plaintiffs, and the Railway Co. was represented by Mr. Bramwell Davis, K.C., and Mr. Mossop.

Mr. Cassel said that the motion was to restrain the defendants from pumping water from their works in violation of an express provision in their Act of Parliament under which they were carrying out these particular works. The action was brought by the Attorney-General at the relation of the Gordon Hotels, who owned the Hôtel Metropole, at the corner of Northumberland Avenue and Whitehall Place, and they were apprehensive that this pumping would endanger their buildings, and other buildings in the immediate neighbourhood. The defendant company was an amalgamation of the Charing Cross, Euston and Hampstead Railway, the Baker Street and Waterloo, and he thought also the Piccadilly, but with that they were not concerned. The defendant company, under an Act of 1911, had power to make a loop line, the object of which was to bring the Charing Cross, Euston and Hampstead into direct communication with the District Railway, the present terminus of the Charing Cross, Euston and Hampstead being under the Charing Cross Station of the South-Eastern and Chatham, and having no connection with either the Charing Cross Station of the District or the Embankment Station of the Baker Street and Waterloo. By the London Electric Railways Act of 1911, which authorised this loop, it was provided that the construction of the railway should be by metal shields worked by hydraulic pressure, and of such length as to protect the soil. Sec. 5 provided that, where fluid was found, compressed air should be applied to prevent the inflow of any sand, silt or gravel, and the excavation should be immediately stopped until compressed-air machinery was provided. Sec. 6, which was the important one, provided that, except in the case of something unforeseen, or for the purpose of removing running water, no use should be made of a pump or other like method of removing water from the works. What the defendants were doing, and, in fact, had done ever since December 28th, 1911, when these works were commenced, was to pump continuously at a point quite close to the District Station. It was not disputed that they had been pumping ever since December, 1911, and that the pumping was still going on, but they said the pumping was now being done by another company. It was, however, admitted that they were doing it up to October 12th at the rate of about 100 gallons a minute. Since the motion was launched, however, an undertaking had been given that the pumping should be as little as possible, and should not exceed 60 gallons a minute. That undertaking was given before the Vacation Judge, and the motion had stood over until that day; but on October 12th the plaintiffs received a letter from the defendants' solicitor to the effect that the Metropolitan District Railway proposed to proceed the following week with works authorised by an Act of 1912, and it would be necessary for them to pump, and that the pumping operations of the defendant company had been suspended for the time being. The letter concluded, and it was written so that the plaintiffs might not in any way be taken by surprise, that the Metropolitan and District were not restricted in any way as to pumping. All the plaintiffs knew was that the same pumping was still continued, though they were now told that it was by a different company under a different Act of Parliament.

Mr. Bramwell Davis said that his clients had ceased pumping, and he was quite willing to undertake to let the plaintiffs have notice if at any time it was proposed to resume pumping on behalf of the London Electric Railways, who were the only defendants to this action.

Mr. Cassel said he felt the difficulty of pressing for an interim injunction when the defendants said they had ceased to pump.

Mr. Bramwell Davis: And my friend shall have seven days' notice of any intention on our part to resume. He could not, he said, give an absolute undertaking that there should be no pumping without seven days' notice as an emergency might prevent such an undertaking being fulfilled with reasonable safety. The plaintiffs, however, might take it that there was no immediate intention by the London Electric Co. to resume pumping.

Mr. Cassel said, under the circumstances, he could not ask for an injunction upon the motion, but asked whether the trial of the action could not be expedited.

His Lordship thought that was reasonable as the motion had not been pressed, and it was no doubt better for all parties that they should know where they stood.

Mr. Cassel suggested that the motion might be used as a summons for directions and the date of pleadings fixed.

His Lordship said that if it was only a question of whether under their Act to pump as they had been pumping, no pleadings would be required.

Mr. Bramwell Davis said that his contention would be that under their Act of Parliament they were entitled to pump, but it was not only a question of whether what they had been doing in the past was authorised by the Act. There was another question, which was, that it was only a trifling amount of water that they had been pumping. The Act said that if unforeseen circumstances arose, they could pump water to a trifling amount.

Mr. Cassel: Thirty-nine million gallons a day.

Mr. Bramwell Davis: That is a matter of evidence.

After some further discussion, it was agreed that the motion should stand over until the trial of the action, with liberty to bring it on again if necessary, the plaintiffs to have leave to amend, and the defendants to give seven days' notice of any intention on their part to resume pumping. Leave was also given to the parties to appeal in Chambers for inspection if they were unable to come to a mutual arrangement.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PROPOSED NEW DUTCH TARIFF.—The Board of Trade have just issued a translation of a proposed new Dutch Tariff. The draft tariff previously issued has been considered by a Committee of the Netherlands Government for upwards of a year, and the rates now published are those finally suggested by the Government. The following are the changes which, if carried into effect, will most interest readers of the Electrical Review:—

	Present rate, *ad val.*	Proposed rate, *ad val.*
Cables and wire of copper for electric installations insulated and other copper wire having material wound, spun, or plaited round it ...	5 %	6 %
Articles and manufactures of copper, brass or bronze not separately mentioned:—		
Roughly worked	5 %	10 %
Polished, lacquered, &c.	5 %	12 %
Porcelain for the insulation of electric current ...	5 %	6 %
Glass globes for the manufacture of incandescent electric lamps	5 %	Free
Asphalte and asbestos paper...	5 %	10 %
Rolling stock for railways and tramways	5 %	10 %
„ „ for transportable railways	5 %	6 %
Machine tools, boilers, pumps, refrigerating machines and air-compressors with fittings ...	Free	6 %
Accumulators	5 %	Free
Dynamos and electromotors	Free	6 %
Hoisting and conveying appliances worked by machine or hand-power...	5 %	6 %
Accessories for steam, water and ventilating installations, such as cocks, shut-off valves, &c.:		
(*a*) Fastened to or imported with the plant ...	Free	Free
(*b*) Other	Free	6 %
Appliances (apparatus) not being machine or hand tools, not separately mentioned	Free	6 %
Implements not separately mentioned	Free	Free
Parts of driving machinery, such as axles, couplings, crankshaft bearings, transmission belts, &c.	Free	6 %
Engine and boiler packing	Free	6 %
Mathematical, physical, surgical, optical and electrical instruments and apparatus not separately mentioned...	5 %	6 %
Lamps and ornaments for gas, electric or other means of lighting, with or without the globes belonging thereto, not separately mentioned	5 %	12 %
India-rubber manufactures not separately mentioned	5 %	12 %
Celluloid manufactures not separately mentioned	5 %	12 %
Asbestos, even if mixed with other substances:		
Worked, not separately mentioned	5 %	6 %
Mica, in sheets not more than 1½ mm. thick ...	Free	6 %
Mica articles, if not separately mentioned... ...	5 %	12 %
Aluminium wire for electric insulation (insulated), other wire having material wound, spun, or plaited round it	Free	6 %
Iron wire with other material wound, spun or plaited round it	Free	6 %

No duty shall be levied:—(*a*) On the packing of imported goods such as cases, barrels, baskets, straw, hay, shavings, &c, serving to protect the goods during the transport from breakage or other damage.

(*b*) On the packing of imported goods, such as large jugs or stone bottles, tins, cases and the like in which the goods are, as a rule, stocked and kept by the person who sells them again, but not delivered to the consumer.

(*c*) On small soldered tins, paper, and tin-foil, in which the goods are wrapped or by which they are separated from one another, small boards or reels round which trimming, ribbon or thread is wound, unpainted and plain (bare) cardboard boxes and similar packing material (even if the goods are packed therein for direct delivery to the consumer, in so far as this packing material as such has no commercial value, or, after unpacking, is no longer serviceable for a similar destination.

A duty of 12 per cent., *ad valorem*, shall be payable on the packing of imported goods not falling under the previous paragraphs, it will not be necessary to indicate in the Customs declaration the correct name of the packing, but it will be sufficient to declare it as packing for retail sale.

The provisions of the previous paragraphs, shall also be applicable to goods on which duty is levied according to a standard other than weight or which are admitted free from import duty.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,402. "Electric controller contact." J. Dawson. October 14th.

23,404. "Sparking plugs for internal-combustion engines and other purposes." A. J. Riley. October 14th.

23,409. "Switchboard connecting cords and the like." P. P. Craven. (Addition to 11,306, 1912.) October 14th.

23,417. "Electrical token apparatus for railways." A. T. Blackall and C. M. Jacobs. October 14th.

23,429. "Composite material suitable for use in the construction of heating elements, rheostats and the like." A. C. Whish. October 14th.

23,430. "Electric ignition apparatus for internal-combustion engines." H. Leitner. October 14th.

23,432. "Dynamo-electric machines." R. A. Holbech. October 14th.

23,450. "Manufacture of explosives, fuses, detonators, percussion caps and the like." A. Jaques and G. Wells. October 14th.

23,451. "Electrical heating apparatus more especially vulcanisers." H. R. Nash. October 14th.

23,453. "Electric incandescent lamps." T. F. J. Truss. October 14th. (Complete.)

23,458. "Transmitting apparatus for use with wireless telegraph systems." W. H. Shephard and A. E. McKechnie. October 14th.

23,475. "Process for the manufacture of chemically-pure tungsten." C. H. Fischer. October 14th.

23,514. "Electric cut-outs." Voigt & Haeffner Akt. Ges. (Convention date, November 2nd, 1911, Germany.) October 15th. (Complete.)

23,520. "Electric shade carrier." A. E. Otway, J. H. Ormrod, and W. J. Purdue. October 15th. (Complete.)

23,527. "Telephone systems." H. F. Taylor. October 15th.

23,542. "Automatic electric current controller for limiting the consumption of current." L. Abbatecola. (Convention date, March 26th, 1912, Italy.) October 15th. (Complete.)

23,545. "Electro-osmotic extraction of water from animal, vegetable or mineral substances." Gesellschaft fur Electro Osmose m.b.H. (Convention date, July 17th, 1912, Germany.) October 15th. (Complete.)

23,564. "Wire terminal plugs." C. E. Mowrer. October 15th. (Complete.)

23,576. "Automatically-operated fans." W. J. Stimson. October 15th. (Complete.)

23,588. "Wall plugs for electrical fittings." F. Scheinig. (Convention date, October 16th, 1911, Austria.) October 15th. (Complete.)

23,590. "Electric clock systems." L. J. Aron. (Convention date, October 16th, 1911, Germany.) October 15th. (Complete.)

23,593. "Filaments suitable for incandescent electric lamps and the like." British Thomson-Houston Co. (General Electric Co., United States.) October 15th.

23,594. "Electric motor-control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 15th.

23,595. "Incandescence electric lamps." J. Red. October 15th.

23,597. "Magnetic speedometers." R. Haddan. (Stewart & Clark Manufacturing Co., United States.) October 15th. (Complete.)

23,605. "Sparking plugs." F. A. L. Johnson. October 16th.

23,607. "Electrical metal conduit cutters." L. H. Marlor, T. G. Hann and J. T. Foster. October 16th.

23,624. "Fittings for electric conduits and the like." C. H. Klyne and S. E. R. Beekroft. October 16th.

23,639. "Trolley poles for tram and like cars." A. Kenneth. October 16th.

23,669. "Motor-controlling switches." W. E. Lake. (Société Anonyme du Temple, France.) October 16th. (Complete.)

23,689. "Turbo-electric machines." A. Rolfe. October 17th.

23,694. "Police call alarms." T. Grant. October 17th.

23,703. "Apparatus for automatically controlling electric heaters or the like." G. Wilkinson. October 17th.

23,718. "Deriving electric current formed by means of thermo-electric elements." P. Ferra. October 17th.

23,726. "Apparatus for use in the heating or sterilising of fluid by means of electricity." T. McClelland, jun. October 17th.

23,732. "Portable self-contained electric tell-tale and dash-board light." W. H. Cole. October 17th.

23,733. "Electric heating devices." A. E. Woodhouse. October 17th.

23,734. "Reception of electric waves." R. Goldschmidt. (Convention date, October 18th, 1911, Germany.) October 17th. (Complete.)

23,750. "Branch boxes for electric conductors." J. Kramer. October 17th.

23,774. "Incandescent electric lamps and holders therefor." A. W. Beuttell. October 17th.

23,775. "Evacuated envelopes." British Thomson-Houston Co. (General Electric Co., United States.) October 17th.

23,776. "Resinous compositions." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 17th.

23,786. "Cinematographs." R. J. Samson. October 18th.

23,811. "Electric lamps." G. S. Brighten and H. Forster. October 18th.

23,812. "Telephone indicating apparatus." M. S. Conner. October 18th.

23,814. "Fitting electric lamps to firemen's helmets." W. C. Angel and E. A. Creane. October 18th.

23,832. "Electric condensed water cleaners." E. Von Wild and J. de Miquel y Almirall. (Convention date, April 1st, 1912, Spain.) October 18th. (Complete.)

23,850. "Switch-operating devices for tramways and the like." W. Zuckerman. October 18th.

23,860. "Electrical heating devices." A. F. Berry. October 18th.

23,861. "Cooking utensils and other heating apparatus." A. F. Berry. October 18th.

23,869. "Manufacture of mica plate." C. Fischer. October 18th. (Complete.)

23,870. "Device for transferring the energy from one electric oscillator to another by shock excitation." H. Sefton-Jones. (Jacoviello Soc. Anon. and F. Jacoviello, Italy.) October 18th. (Complete.)

23,877. "Plug for electrical plug contacts." H. Stotz and Stotz & Co. (Convention date, October 20th, 1911, Germany.) October 18th. (Complete.)

23,887. "Pocket electric lamp signalling apparatus." H. Neuburger. October 19th.

23,890. "Fittings for electrical conduits." J. E. Noirit. October 19th.

23,911. "Electric driven vacuum cleaning apparatus." W. Griffiths and Wizard Dust Extractor Co., Ltd. October 19th.

23,917. "Electrical current-limiting switches." H. J. Railing, J. Strachan and E. E. Hoadley. October 19th.

23,918. "Automatic electrically operated elevators." R. Liljeblad and Aktiebolaget Elevator. October 19th. (Complete.)

23,940. "Means for indicating when the flow of current in an electric circuit is interrupted." A. F. Berry. October 19th.

23,955. "Sparking igniters for explosive engines." E. A. Raves. October 19th.

23,959. "Process of plating." R. Rafn. (Convention date, October 21st, 1911, Germany.) October 19th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electric Furnaces. A. L. J. Queneau. 19,805. August 29th.

Apparatus for giving Intermittent Flashes of Light. Julius Pintsch Akt.-Ges. 19,369. August 30th. (January 16th, 1911.)

Method of Electrically Bonding, and a Bond for Rails or the like. E. Vedovelli. 21,720. October 2nd.

Telephone Instruments. W. H. Derriman. (Automatic Enunciator Co. 21,812. October 3rd.

Telephone or like Instruments. W. H. Derriman. (Automatic Enunciator Co.) 21,814. October 3rd.

Telephone Systems. W. H. Derriman. (Automatic Electric Co.) 21,815. October 3rd.

Vapour-Electric Apparatus. P. C. Hewitt. 21,827. October 3rd.

Elevated Railway for the Conveyance of Passengers' Luggage and other Goods. S. Arnold. 22,406. October 11th.

Electric Incandescent Lamps. A. W. Gast. 22,779. October 16th.

Electric Lamps. W. H. Fulper. 22,925. October 17th.

Photometric Apparatus for Indicating and Measuring Changes in Electrical Pressure. J. S. Dow. 23,931. October 28th.

Wireless Telegraphy. J. Gardner. 25,278. November 14th.

Electric Diaphragm Horns and like Sound-Producing Means. W. P. Thompson. (Akt.-Ges. Mix Genest Telephon and Telegraphenwerke.) 25,489. November 15th.

1912.

Electric Frequency-Indicating Instruments. British Thomson-Houston Co. (General Electric Co.) 628. January 8th.

Apparatus for The Operation of Electrical Clocks by Electric Waves. F. Schneider. 3,966. February 16th.

Systems for Operating or Controlling Time Indicating Devices. L. J. Aron. 7,626. March 29th. (Patent of addition not granted. Divided application on 12,660 of 1911, September 28th.)

Trolleys or Overhead Collectors for Electrically-Driven Vehicles. R. Francq and V. Francq. 7,772. March 30th.

Electric Arc Lamps. W. Schaffer and Heimann. 8,140. June 21st. (April 5th, 1911.)

Electromagnetically-Operated Switches, Particularly Adapted for Controlling Electric Motors. E. Schattner. 8,078. April 12th.

Anode Supports for use in Electroplating. Spirella Co. of Great Britain. (Spirella Co.) 9,149. April 18th.

Apparatus for Winding Incandescent Electric Lamp Filaments on their Supports. Soc. Francaise d'Incandescence Par le Gas (System Auer). 10,092. April 26th. (May 1st, 1911.)

Alarm Signalling and Controlling Devices. A. Richter and Bock. 10,223. April 30th. (Divided application on 21,959 of 1911, October 5th.)

Searchlights. L. Pasqualini. 13,679. June 11th.

Method of and Apparatus for the Electric Transmission of Signs or Speech in Mines. J. H. Reineke. 15,256. June 29th.

Plug Connections for Electrical Work. A. A. Warner. 17,151. July 2rd.

Metalliferous Mine Installations.—Electrical installations in metalliferous mines sometimes call for a considerable amount of attention owing to the fact that in the first instance they were designed and put to work without due regard to the special conditions which obtain in mining practice. It is unsafe to apply, without modification, designs which may prove satisfactory for factory or similar installations above ground, inasmuch as the conditions are quite different, when one comes to consider the mining proposition. For example, the temperature in a mine is often very considerably above that attained on the surface, and there is a large amount of dust and damp usually present, all of which tends seriously to militate against the successful operation of such systems. For this reason, the use of the ordinary type of lampholder in the lighting of pit bottoms, shafts and roads is highly inadvisable, owing to the large amount of dust and damp which get into the holders. Under such circumstances, it is almost certain that there will be an accumulation of verdigris on the contacts and lamp tops, which in its turn will cause short circuits.

The ideal fitting for lighting purposes is a type constructed of porcelain, with the wires led in from either side, and having contacts sunk in the porcelain. If the lamp is then protected by means of a good thick well glass with a ring or hanging lip, and the use of flexible wire is avoided, it is probable that a great improvement will usually be found in the working conditions attending the use of electric-light in mines. For connecting-up purposes, two leads should be run from the mains, of 3/22 gauge, insulated with vulcanised india-rubber.

In some mines a good deal of reliance is placed upon the use of porcelain insulators for low-pressure power circuits, but it should be pointed out that, especially when the mine is situated in moist tropical climates, the use of single-shed insulators is likely to prove unsatisfactory, inasmuch as there is sure to be a very considerable amount of leakage. So pronounced was this defect in one instance in the tropics, that the whole system employing the use of single-shed insulators was replaced by three-shed insulators, and when tests were made, a very much more satisfactory result was obtained than before.